THE HEATING AND VENTILATING MAGAZINE

1123 BROADWAY NEW YORK FEBRUARY, 1905

ELEVENTH ANNUAL MEETING AMERICAN SOCIETY OF HEATING AND VENTILATING ENGINEERS.

Hotel Astor, New York City, January 17, 18, 19, 1905.

In the history of the American Society of Heating and Ventilating Engineers it has been true with scarcely an exception that the latest meeting was always the best, excelling previous meetings in point of numbers and commonly in the interest attached to the proceedings.

The eleventh annual meeting was not one of the exceptions. The number of members and guests registered, large though it was, does not tell the story because it was readily noticeable by those who have made a practice of attending all of the meetings of the Society that the number who remained steadily in the assembly room far exceeded anything in the Society's previous history.

The opening session of the meeting was called to order Tuesday afternoon at 3 o'clock by President Andrew Harvey.

The secretary's register shows the following list of members and guests, in addition to which there are a number who did not register.

LIST OF MEMBERS AND GUESTS

Andrew Harvey.
William Kent.
J. J. Blackmore.
C. B. J. Snyder.
Henry Adams.
D. M. Quay.
W. M. Mackay.
A. E. Kenrick.
R. C. Carpenter.
U. G. Scollay.
Harrie D. Crane.
Wiltsie F. Wolfe.
S. A. Jellett.
Frank K. Chew.
F. G. McCann.
H. L. Anness.
A. A. Cary.
C. M. Slotboom.
E. J. Febry.
J. S. Brennan.
H. A. Joslin.
B. F. Stangland.
H. A. Smith.
Joseph Graham.
C. V. Kellogg.
J. S. Furnee.
J. O. Galloup.
L. B. Sherman.
George Klemm.
G. W. Clark.
Frank Dobson.
A. A. Cryer.
A. C. Edgar.
Warren Webster.
Theo. Webster.
J. H. Davis.
Bernard Gause.
J. A. Goodrich.
R. P. Bolton.
A. M. Feldman.
J. R. Shanklin.
C. M. Lyman.
C. Teran.
J. A. Almirall.
W. H. McKiever.
A. P. Broomell.
F. P. Blodgett.
W. H. Driscoll.
W. H. McKiever.
B. H. Carpenter.
W. C. Vrooman.
C. R. Bishop.
H. W. Nowell.
H. J. Barron.
James Curran.
Geo. O'Hanlon.
J. B. Bernhard.
G. B. England.
R. R. M. Carpenter.
Thomas Barwick.
H. H. Ritter.
W. K. Downey.

PROF. WILLIAM KENT, OF SYRACUSE, N. Y.
NEWLY ELECTED PRESIDENT.

N. P. Andrus.
E. F. Capron.
E. K. Monroe.
H. B. Gombers.
L. Wheeler.
T. R. Quay.
Harry Godfrey.
R. T. Childs.
F. J. Vaux.
Richard Hankin.
J. A. Payne.
M. P. Osbourn.
T. B. Cryer.
P. H. Seward.
C. C. Mulford.
B. Mills.
C. R. Moses.
August Gieger.

REGINALD PELHAM BOLTON, NEW YORK
FIRST VICE-PRESIDENT

D. Burgomaster.	J. H. Bowers.
T. J. Ward.	A. J. O'Neill.
J. J. O'Brien.	C. H. Baker.
P. C. Doherty.	F. L. Jones.
H. C. Eddy.	C. F. Armstrong.
H. C. Mallory.	C. D. Bradt.
Dr. J. M. W. Kitchen.	A. F. Robinson.
E. D. Winslow.	Chas. Paradice.
E. W. Barnes.	Harvey Metz.
R. B. Hurd.	A. B. Stoddard.
J. C. Faulkner.	A. T. Nickinson.
E. Suyeman.	E. F. Singer.
W. C. Austin.	E. J. Olmstead.
H. Cullalhoy.	E. T. Child.
H. C. Adams.	F. A. Dwyer.
W. T. Donnelly.	L. C. McCrum.
W. Baker.	T. Kieley.
C. H. Basshor.	Geo. Huey.
T. H. Stevens.	H. D. Carter.
Chas. Andrews.	E. C. Molby.
W. W. Macon.	Hon. A. A. Wray.
J. P. Sadler.	J. W. Fryer.
G. G. McDuff.	F. H. Fairweather.
J. J. McDonald.	F. B. Miller.
D. Stuart.	J. C. Blerney.
L. H. Sanford.	J. Flockhart.
F. Peacock.	John Turner.
F. C. Eckfeldt.	Fred. Castle.
A. S. Armagnac.	C. E. Scott.
F. C. McLain.	Archie Beith.

Mr. Harvey then read the following:

PRESIDENT'S ADDRESS

It is with pleasure, and I fully appreciate the honor which gives me the privilege of welcoming you to this our eleventh annual meeting. Some of you may not know the reason why we have met in this place instead of holding our annual meeting in the hall of the American Society of Mechanical Engineers, as we have done in the past. Your Board of Governors, at its meeting in September, was informed that in all probability the old building in which these meetings have been held would be torn down during this year, and they thought it best to try the experiment of holding this annual meeting in a hotel, so as to make the fact more prominent, and to give the members an opportunity of taking whatever action they might think would be for the best interest of this society. It will be necessary to arrange some suitable place for holding our meetings, at least until the new Carnegie Engineering Building is completed, on condition that satisfactory arrangements can be made, which may mean several years.

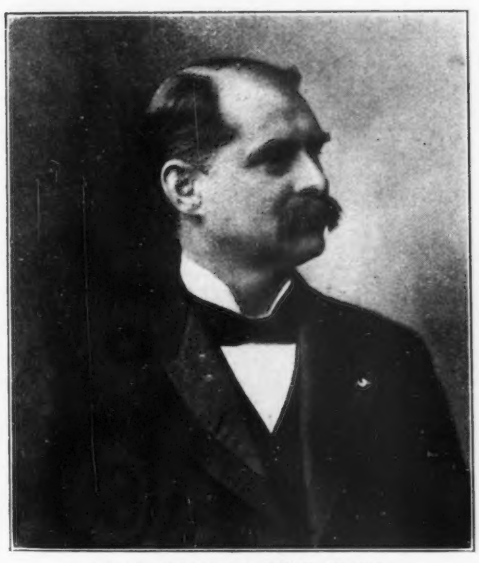
I desire to express to the officers and members of the society my appreciation of the efficient manner in which the suggestion of making the tenth anniversary meeting prominent in the history of the society was met. And now, as we have entered the second ten years, with the knowledge of success of the past before us, what may we not expect in the coming years? We have among our members most of the best known heating and ventilating engineers of this country and quite a number from foreign countries. I believe about 10 per cent. of our members are foreigners, and this fact

C. B. J. SNYDER, NEW YORK
SECOND VICE-PRESIDENT

suggests a point which may be worth considering at some time in the near future—that is, Would it not be for the best interest of this society to hold a summer meeting in some city in Europe so as to give the American members an opportunity of meeting our foreign brothers in their own country? I am sure that every member who could go over there would find it one of the best investments he ever made. Most all of the other American engineering societies have done so in past years and have been much benefited by the results.

I must congratulate the members on having accomplished one of the most important acts this past year that has ever been done by this society since its organization. That is the adoption by the New York Legislature of a State law passed last April, for the proper construction and ventilation of school buildings, which is the result of the persistent and untiring efforts of our eastern members and is surely a very creditable accomplishment, which adds much to the reputation of the society. I trust that within the next 10 years the people of every State in the Union will have become so well informed of the necessity for properly ventilated schools and public buildings that it will be considered as great a crime to construct these buildings without providing for sufficient and proper ventilation as it would be to erect a building without a proper foundation. The information the law makers of the State require must be supplied by the heating and ventilating engineers of this society, and this fact should inspire every member to do his best.

Secretary W. M. Mackay presented the following:



W. M. MACKAY, NEW YORK
SECRETARY

U. G. SCOLLAY, BROOKLYN
TREASURER

Secretary's Report

Your secretary would report an increase in membership during the past year. At our last annual meeting our membership was composed of 185 members, 1 honorary member, 15 associates and 2 juniors, or a total of 204 members of all grades. During the year we have added 24 members, 4 associates and 2 juniors. Two members failed to qualify. 5 members have been dropped from the roll for non-payment of dues, 5 members have resigned and 2 members have died since the last annual meeting. Mr. Stephen G. Clark, who became a member on December 29, 1902, died on February 13, 1904, and Mr. Charles M. Wilkes, who became a member in January, 1897, died January 7, 1905. Our present membership is 198 members, 1 honorary member, 16 associates and 5 juniors, or a total of 220 members of all grades, making a net increase of 16 during the past year, in addition to which we have a number of applications to be acted upon and voted on after the annual meeting.

The financial affairs of the society are in good condition. At the last annual meeting there was a balance in the hands of the treasurer of $543.49. We have received from all sources during the past year $2,414.99, which, with the balance on hand, made a total of $2,958.48 available. The expenditures amounted to $2,274.29, leaving a balance in the hands of the treasurer of $684.19. There is a balance owing from members for dues and from newly elected candidates for

B. H. CARPENTER, WILKES-BARRE, PA.
BOARD OF GOVERNORS

membership, for initiation fees and dues, amounting to $655, which, with the balance on hand, amounts to $1,339.19. We have no unpaid bills except those in connection with the present meeting, which have not yet been presented, and the secretary's account, amounting to $100.74, so that, deducting this, with the amount on hand and owing from members and others, we have a balance of $1,229.63.

The members dropped from the rolls during the year owed the society a total of $150. The secretary's expenses for the year, including stenographer, clerk hire, rent of post office box, expenses in connection with the summer meeting, postage, expressage, etc., amount to $587.21.

The 1904 Proceedings have been edited. They are now being corrected and will be forwarded to the members as soon after this meeting as possible. The cost of the editing and printing of these proceedings will amount to about $900. The society held a successful meeting at Detroit, Mich., July 15 and 16, 1904.

All the papers to be presented at this meeting with the exception of one, which will be read from manuscript, while received late, have been printed and forwarded to the members.

Treasurer's Report

U. G. Scollay, treasurer of the Society, presented a brief but comprehensive report, showing that the expenditures of the year have been $2,274.29, with receipts of $2,958.48; balance on hand, $684.19.

Mr. H. D. Crane of the Board of Governors, presented the following:

Report of Board of Governors

The report of the Board of Governors, presented by H. D. Crane, is as follows:

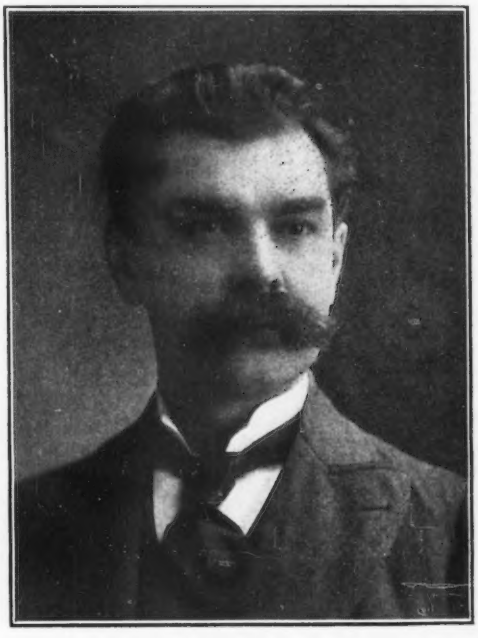
Your Board of Governors met and organized January 21, 1904, appointing committees on Finance, Membership and Publication, and an Executive Committee. The various committees have given careful attention to their duties and the Board has met as often as was found necessary during the year. We are able to report an increase in membership and the financial affairs of the society in good condition, with sufficient funds on hand to pay for the publication of the 1904 volume, which has just been corrected and which will be forwarded to the members as early in the year as possible.

According to a resolution of the last annual meeting, the Board of Governors met and revised such parts of the by-laws as were complained of at the last annual meeting relative to the election of members and duties of officers sending out a letter ballot to the members. Seventy votes were cast, 69 being in favor of and 1 against the amendments, which were adopted. A revision of the constitution and by-laws, with a revised list of members to December 15, 1904, has just been published and will be forwarded to the members this week.

A summer meeting was arranged for July 15 and 16, 1904, at Detroit, Mich., which proved successful in every way.

Committee on Compulsory Ventilation

The report of this committee was presented by B. H. Carpenter, reporting the



JAMES MACKAY, CHICAGO
BOARD OF GOVERNORS

passage of a law by the Senate and Assembly of New York State, which law was printed in full in our January number and is generally familiar to most of our readers.

The report stated that copies of the new law had been so distributed as to bring them before the legislatures of other states, in the expectation of a resultant extension of the New York law everywhere in the course of time.

The report embodied a recommendation of a resolution of thanks to C. W. Boal and Andrew W. Edson, of the Educational Department of New York State, these gentlemen having done good service in helping to secure the passage of the new law.

On motion, the report of the committee was adopted.

British Heating and Ventilating Engineers

The secretary read a cablegram from the secretary of the British Institution of Heating and Ventilating Engineers, the date of whose meeting coincided with that of the American meeting.

The message from across the sea read as follows: "The English Institution assembled sends greetings."

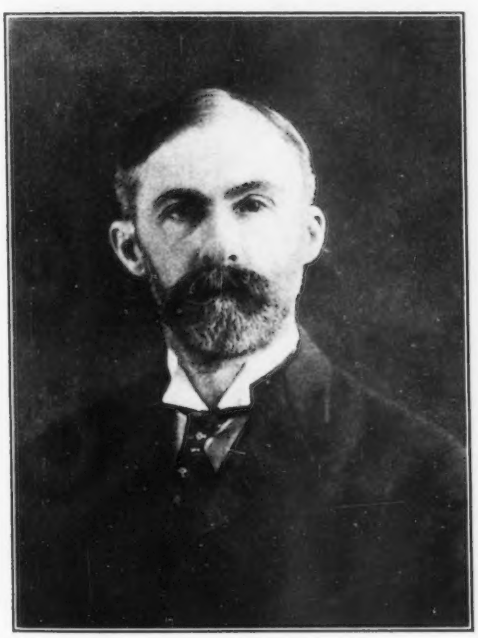
New Business

A. A. Cary: That a committee has been formed, composed of officers of four engineering societies, the American Societies of Civil Engineers, Mechanical Engineers, Mining Engineers and Electrical Engineers, for the purpose of agreeing upon certain abbreviations to be used in their transactions.

I think we should also come up in line and have our transactions agree in abbreviations with the transactions of the other societies. I cannot say that I agree with every one of the abbreviations offered, but it is pretty hard to agree upon everything that somebody else has gotten up. In the main they are satisfactory and I move, that in our transactions these abbreviations be adopted, to conform with those of the other four engineering societies.

The motion, being seconded by Professor Kent, was referred to the committee on Standards.

J. C. F. TRACHSEL, PHILADELPHIA
BOARD OF GOVERNORS



B. F. STANGLAND, NEW YORK
BOARD OF GOVERNORS

SECOND SESSION—TUESDAY EVENING

President Harvey called the Association to order Tuesday evening at 8 o'clock and the tellers made their announcement of the election of officers for the ensuing year, as reported in the Magazine for January.

James A. Donnelly being absent on account of illness, his brother, W. T. Donnelly, read a paper on "Some New Appliances and Results in Exhaust Steam Circulation," printed in full in the January Magazine.

Discussion

Mr. Osbourn: In describing the Long Island State Hospital, you say: "There are about twelve hundred automatic pressure motor valves used." What is the character of these valves?

Mr. Donnelly: A valve patented by me in 1900.

Mr. Osbourn: Aren't such valves now known as the Webster valves, generally, and actually used in the Webster system?

Mr. Donnelly: I think so.

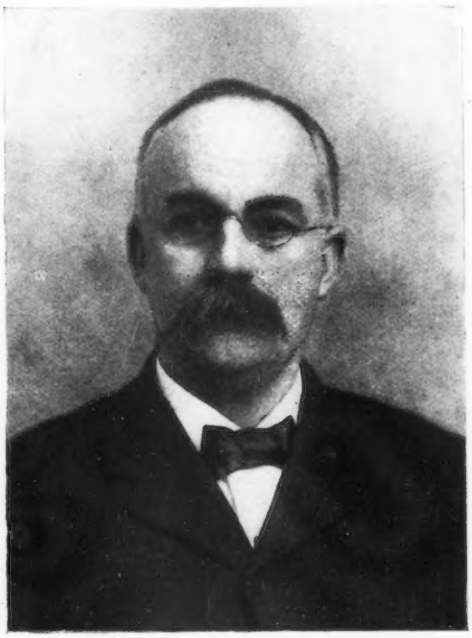
Mr. Osbourn: Don't you regard the Kings Park plant as the Webster system?

Mr. Donnelly: Yes; with some modifications.

Mr. Warren Webster: This paper refers to the possible economy of 3,000 tons in one season by the installation in the Long Island State Hospital. As long as that is stipulated as a possible economy, I should like to ask Mr. Donnelly whether it is implied that this economy is effected by anything that he has attached to the system, in addition to the original Webster system installed there by Mr. Donnelly.

Mr. Donnelly: Economy in vacuum systems usually comes from using something unused before, and if there are 3,000 tons saved in one year in this King's Park building, it will be due to the fact that before there were 3,000 tons, or that value of exhaust steam, hitherto unused. The method of making this economy did present some difficulties, and there were some unusual precautions taken to keep the steam out of the main return. I stated what those were—cutting down the vacuum, automatically in some cases and in others by hand, in the several buildings. As to whether the economy could not have been accomplished without any special appliances which were put on it, I do not think so. The conditions there are such that some time ago we opened the returns ing it going that way, but directly into the main return, and shut off the vapor going into the hot water tanks, preventing it going that way, but directly into the main returns and shut off the vapor going into the auxiliary. The vacuum at the pumps fell rapidly until there was no difference in pressure. The circulation entirely ceased. Inside of an hour we were compelled to close up the passage directly into the main return and allow the vapor to take its course through the hot water tanks and through the cooling air ducts.

In the majority of these cottages, there are automatic valves of the pressure type and the vapor passes through these valves when in good condition. There are three men continually going over them so that they are kept clean and in working order. Still, the vapor has always been sufficient from these eighteen to twenty valves to heat this hot water tank, keep it warm in the conduit, keep the hot water pipe warm to the cottage, in no cases less than 50 feet and in more cases 200 or 300 feet, and there was the water necessary to bathe sixty patients in these cottages—it is very seldom that the steam is turned onto that tank. When that steam condenses the vapor from the return goes through a coil in the hot water tank. Probably that heats the water as high as 190 or 200, in many cases, but naturally cannot make it go over the boiling point as the vapor going through is less than the atmospheric pressure. The trouble with the hot water system there has been less than formerly through the advantage of this constant supply which heats the water to a maximum temperature. I believe some steam does go around the main return, but probably very little. So, answering Mr. Webster's question, I should say the plant at King's Park operates with considerable more success



A. B. FRANKLIN, BOSTON, MASS.
BOARD OF GOVERNORS

because it has some of these precautions taken, and I think would operate better if more were taken.

Mr. Tellett: I note the total coal consumption is 15,000 to 16,000 tons per annum. What proportion is required for the heating system? I note the main boiler house has six Fitzgibbons boilers of 150 horse power each for pumping water. Of the 15,000 tons per annum a certain amount is used all the year round, for power purposes evidently. The heating system I presume is limited to about five months in this section. I want to know the amount of coal burned in five months for such a heating system, under average conditions, so as to see where the saving of that 3,000 tons applies. At first reading, you would take

3,000 to be 20 per cent. of the total coal consumption. It is certainly very much more than 20 per cent. of the coal burned for heating purposes only. The paper gives in one place 50,000 feet of direct radiation. It cannot take any such amount of coal to supply steam for 50,000 feet of radiation. I want to know where that difference comes in.

Mr. Donnelly: The question is complicated by the kitchen apparatus, the laundry and other things which tend to make it a complex problem. The average coal consumption in the summer time heretofore has been 900 tons per month, which would be 10,000 tons per year—about 5,000 tons for heating. This coal consumption was cut down last summer to approximately 780. The only heating done during the summer months was heating water and they had to keep the entire steam main going throughout the installation.

Mr. Jellett: About four tons a day.

Mr. Donnelly: This is also affected somewhat by the fact that previously the steam for two engines was carried something over half a mile, and that distance has been cut down a little and the supply pipe cut down very much, so where it was carried in a 10-inch pipe it is now carried in a 6 and 4-inch pipe, and there is a saving by transferring the biggest part of the kitchen load to the main boiler house.

As to the use of steam for the kitchen it has been remodeled, and, instead of keeping the steam main hot in summer time with live steam, the steam main now is kept hot with exhaust steam, but the smaller main is kept hot with live steam, so that all the saving is simply due to one cause.

Mr. Jellett: I could not figure how, for heating that amount of heating surface for six months in the year, it was possible by any system to save 3,000 tons of coal. The record shows that the amount of coal actually used for heating these buildings during five months will not exceed 5,500 or 6,000 tons, and a saving of 3,000 tons on that would be abnormal under any conditions.

Mr. Barron: Do you advocate using the differential controlling valves on each set of risers of a building of that character?

Mr. Donnelly: Provided the return risers were properly sized through the building. Care should be taken in sizing the connections with the risers and differential controlling valves. It would depend somewhat on what type of automatic valves is used in the radiators. It was not my intention in writing the paper to produce the impression that such a simple type of valve as this impulse valve is the only one that will work with the differential controlling valve.

Mr. Webster: In an experience of about fifteen years and having handled about a thousand plants, we have never had a plant where we could not handle those conditions without the necessity of differential pressure reducing valves. We have handled lifts 1,600 feet from the vacuum pump without the necessity of any auxiliary condensing surface on the delivery side of the automatic valve. The question of engineering is, of course, a very important feature, and details must be properly looked after. There is no necessity for the improvement Mr. Donnelly refers to.

TOPIC

"The Ventilation of Tunnels, Subways and Kindred Constructions."

DISCUSSION

Mr. Cary: I was at one time connected with a tunnel investigation, which led to my designing a system for ventilating tunnels. Subways cannot be ventilated, but if it is a tunnel ventilation is possible and easily arrived at. You often see a system used in which they run a number of bifurcated pipes in a fan opening and collect the air that way. The only way to collect the air into one fan from a number of different openings is to place a suction box outside the fan and from the box you can carry a number of pipes in different directions and get good results, which is the plan I have used in this case.

This plan was not adopted, although it acted against the railroad. You will probably remember the horrible accident that occurred some six months or less after the date of this design, in which a great many people were killed, and it was due entirely to the obscuring of the signal lights so that the engineer could not see the danger ahead, and the consequence was the train was wrecked and a great many lives lost. The railroad officers had in mind the present change, evidently. The trains are to be operated by electricity, and the tunnel is to be double-decked, a tunnel placed underneath the present tunnel, so doubling the trackage available. By exchanging this to electricity many of the troubles will be done away with. The principal trouble leading to the accident was the discharge of steam from the locomotives.

The matter of subways has lately been brought before the people. It is, perhaps, fortunate that our subway was opened at the beginning of cool weather. I remember my first trip through the subway the first day it was opened. I went with a friend from the City Hall to the extreme northern limit and back again, and came out with a severe headache, which I thought probably due to indigestion or something of that kind and I said nothing about it. My friend said, "I have a severe headache." I said, "That is funny." He said, "The trouble must be due to bad air in the subway."

But as the weather became cooler, the trouble ceased and the noxious gases are

floating to and hanging at the bottom of the tunnel. The tunnel is warm and as you stand in the entrances you will find warm air coming up. Newsboys, I see, are quite anxious to avail themselves of this chance to get warm. The colder air is entering wherever it can, and the lighter and warmer air inside is passing up, so there is some ventilation.

Among the numerous statements made as to how the subway could be ventilated, there is a statement which I think was official. It speaks of the piston action of the trains passing up and down. The subway areas being many times the area occupied by the trains would prevent much piston effect. It would be more like a room filled with foul air with one fan simply fanning that foul air backward and forward and not changing it. The movement of trains, I think, will have little to do with ventilating the tunnel. Summer will be here after a while and the outer air will be warmer than the air inside, and there will be those gases which gave so much trouble in the Park avenue tunnel I had occasion to investigate, particularly those from the sewer, carbonic acid and fire damp and sulphuretted hydrogen. If there is any breakage along the line of this tunnel where sewage flows in, many gases heavier than the air will remain in the bottom. The carbonic acid given off by the travelling public will remain in the bottom of the tunnel during the summer months. Carbonic acid is one-half again as heavy as air, and sulphuretted hydrogen is one-fifth heavier than air. I think during the coming summer we shall hear many complaints as to lack of ventilation in the tunnel.

Mr. England: Mr. Cary says these gases will collect in the tunnel and stay there because they are heavier. I think it is a known fact that these heavy gases will diffuse among the other gases. I don't think they will stay in the tunnel, because the trains moving all the time will stir them up, and in that way they will diffuse. I know in a deep hole or a deep well carbonic acid gas will collect and stay there a certain length of time, but it has a tendency to diffuse with other air when it comes in contact with other air.

Mr. Cary: All gases will diffuse and spread themselves through space up to a certain limit. There is a time when gases will accumulate, and taking some heavier gases, as carbonic oxide, they will fall to the bottom and remain, and you will find them in excess there to the air higher up. Diffusion is a slow process. If it were not for diffusion, we would be able to accomplish some wonderful results.

I had a case brought to my office by a man who made the great discovery that the atmosphere was composed of two gases, and by the use of centrifugal fans he thought that he had a cheap device for getting fire, but he didn't appreciate the fact this gentleman has brought up concerning the diffusion of gases. Gases will accumulate and they will diffuse up to a certain extent, and the more the air becomes charged with these gases the less their ability to take up other gases and allow the diffusion to go on.

THIRD SESSION—WEDNESDAY AFTERNOON.

Professor R. C. Carpenter read a paper on "Investigation of Accuracy of a Direct Reading Hygrometer," printed in full in our January number.

Professor Carpenter: My conclusions were that this simple instrument is one which will show with a fair degree of accuracy the moisture contents of a room. There may be an error of 2 to 5 per cent. The cost is small and I believe it would be well worth while for most mechanical engineers to have one.

I have been investigating the amount of moisture in my house during the last two months with an instrument of this kind—the house being heated by steam, and perhaps a fairly representative steam-heated house.

I find that the moisture contents, in per cent. of saturation, runs from about 8 to 35 per cent., and a good deal of the time it stands at about 25 per cent. I took the instrument out of doors, and at the same time found the per cent. of saturation to be 60 to 70 per cent., so that the air in my house is extremely dry.

Mr. Barron: I want to ask Professor Carpenter what he finds is the percentage of moisture on the average outside his house and the percentage inside?

Professor Carpenter: We made a number of observations outside, and, I think, we never found a time when the moisture was not over 60 per cent. and sometimes almost to saturation. I think once or twice we found it nearly 100 per cent., but I should say the average during the winter time was in our locality, taking the last month as a basis, say, approximately 80 per cent.

Mr. Barron: What is the percentage inside your house?

Professor Carpenter: At the same time it would not average over 25 per cent. —15 to 30 per cent. The house is located on high ground.

Mr. Wolfe: These tables, as I understand you, were taken from government reports?

Professor Carpenter: Yes, sir.

Mr. Wolfe: Ordinarily, people reading the hygrometer forget the matter of temperature. Of course, we know 100 degrees will carry more water than 70 degrees.

Professor Carpenter: Scientific tables giving the relative humidity of the air and the amount of moisture absorbed by the air are to-day entirely different from tables published ten years ago even. I think the United States Weather Bureau

has published different sets. I think the table given in my paper is—I will not say accurate—but the best authority we have at the present time as to the amount of water held in the air at different temperatures and under different conditions. Table 2 shows the relative per cent. of saturation for different readings of the dry and wet temperature. The last table shows how much water is held when the air is saturated, at different temperatures. Of course, it shows air will hold, when heated to a temperature of 100 degrees, in a thousand cubic feet, pretty nearly three pounds, and in a thousand cubic feet when the air is 20 below it only holds .03 of a pound, an exceedingly small amount.

Mr. Barron: Can you give us some general averages of the moisture in the air, ordinary average through the whole winter?

Professor Carpenter: I think it is not far out of the way to say that during the winter months the percentage of saturation of outdoor air doesn't run far from 70 per cent.; in summer, not quite so high. I think that in the house 25 per cent. is not far from the average. It is quite probable that if we run our moisture up to 60 per cent. we can run our comfortable temperature down eight or ten degrees. At one time in some portions of the country it was a good deal cheaper to let the natural gas burn than it was to use exercise enough to turn it off, and as a result, in using natural gas temperatures were allowed at times to get high. The rooms were very dry and the people living in these rooms wanted the temperature something like 70 or 80 degrees in order to keep comfortable. In the extremely dry air they felt chilly unless they had a high temperature.

Mr. Kitchen: What degree of saturation is the most healthy condition? I know from my own experience that moist, summer temperature gets disagreeable with a high saturation. I have a place in New Hampshire where it is extremely dry and we can live in comfort there in summer with the temperature out of doors at 60 degrees, whereas in East Orange to be comfortable in the house we have to have about 75 degrees.

Professor Carpenter: We haven't been talking much about healthfulness in our discussions, but about feeling comfortable. It seems, however, fairly probable that a moderate degree of saturation is more comfortable and healthful also than extreme dryness or extreme dampness. We know extreme moisture is not healthy. Fifty to 60 per cent. is certainly a healthful amount of moisture. But on the other hand we know certain diseases require extremely dry air in order to be properly treated. So the question of health is very complicated.

Professor Kent: I think there was a discussion of this subject at the last meeting. It used to be that all the furnace-heat men thought it necessary to have a water pan in the furnace to make moist air. In Syracuse I find the custom is not to have water pans at all. We have an extremely dry atmosphere there in the winter time. Last winter it was 20 degrees below zero sometimes, and every one expressed the feeling that they didn't feel the cold at twenty degrees below as much as the people in New York City at zero.

Some years ago in Pittsburg, in the steel works, it was noticed in June, when the thermometer got to 90 in the shade, that the men were quitting work and it was very hard to keep a full force. In September, with the temperature 102, not a man left. It was dry, but at 102 the men didn't suffer from the heat, but they suffered badly with the thermometer at 90 in June and with maximum humidity.

On the other hand, I know doctors treat some cases by keeping the air saturated with moisture, while for lung diseases the patients go to Arizona to get dry air.

Mr. Blackmore: Professor Kent says they have weather in Syracuse below zero. It is well known that when the air is below zero it is able to carry very little moisture. The introduction of that dry air at that low temperature on a heated surface as a hot air furnace, puts the air in a condition where it has an intense thirst for moisture. If that is not supplied in the furnace it will be taken out of the occupants in the rooms or anything that contains moisture. Any one sitting in such a room—no doubt every one of you have felt it at times—feels a parched condition of the skin; we feel uncomfortable, we feel thirsty, we feel as though we must have a drink, and yet I doubt if any of us have sat down and thought what was the cause of that condition.

Mr. Wolfe: During my practice as a heating and ventilating engineer I didn't depend altogether on the water pan. I would use what might be called a water pan, in which I suspended cotton cheese cloths, which became moist through capillary attraction. I figured that with the humidity ranging from 60 to 65, the temperature at 70 was entirely satisfactory in every way. I always endeavored when a test was to be made to have it that way. I found with too many cloths the humidity was too high, and worked on the basis of 70 degrees of temperature with the humidity from 60 to 65, assuming that the occupant would be under sixty years of age.

Professor Kent: I presume that is a typographical error where it says "calcium chloride or phosphorous."

Professor Carpenter: That is a mistake. I am glad you called my attention to it.

Mr. Chew read a paper on "Gas as a Fuel for Hot-Air Heating," by R. S.

Thompson, printed in full in our January number.

DISCUSSION

Mr. McCann: I want to ask the gentleman who read the paper, how is he going to separate the air for ventilation from the air for recirculation?

Mr. Chew: In the West, more than here in the East, they circulate the air, depending almost entirely for ventilation on what will come in around the windows and doors.

Some men hold there should be absolutely no circulation of the air. The "rotary system" is the circulation in the West and Northwest where the temperature goes to 40 and sometimes 60 below zero.

So far as separating it, I don't think even the most pronounced advocates of the system make any claim for that. The hot air passes from the furnace which has to be filled, and it will be filled if there are no restrictions. It is not uncommon in this section of the country where the circulating system is used to restrict the outside supply and draw the supply from the inside of the building, and in that way you have enough air to fill all the hot air pipes, but if there is not enough air from the inside then it will come from the outside, so that the question of separation for ventilation is a good deal like some medicines, some high potency and some high——

Professor Kent: I wish the author had given some proofs of some of his statements, for to my mind some of them are not quite accurate. He says: "If more air is mixed with the gas than required, combustion will be imperfect and part of the gas unburned." I do not think that is strictly accurate. If you try to burn gas with exactly the amount theoretically necessary, you will have imperfect combustion. It requires usually about 30 or 40 or 60 per cent., maybe, excess of air in order to insure the products of combustion; and if you go beyond that and give 100 per cent. excess or even 200 per cent. excess I think the combustion will be perfect. I can scarcely imagine a condition in which excess of air will cause the production of carbon monoxide and make combustion imperfect, refusing to burn the hydrogen and letting the hydrogen pass off unburned.

He says also, "If any portion of the burned gas mixes with the fresh gas it poisons the latter and there is imperfect combustion, for a small amount of carbon dioxide mixed with gas renders the whole mixture incombustible." I think that is entirely wrong—that you can mix very large quantities of carbon dioxide gas with incoming air and have perfect combustion. It is found in gas engine practice they can get good combustion from natural gas. Blast furnace gas contains about one-half as much carbon dioxide as carbon monoxide gas, is thoroughly poisoned with nitrogen and with carbon dioxide and yet that gas is combustible, and we find that gas is burned in blast furnaces and heating ovens.

Professor Carpenter: I do not understand this quite as Professor Kent does. I understand this paper to refer, in a very brief way, to some difficulties which come from burning gas. I think he has exaggerated in a marked degree some of the troubles. I know in burning natural gas, especially an open flame, it is exceedingly difficult to avoid smoke. We are likely to burn out the hydrogen first, leaving black specks.

Professor Kent: There is another statement: "There is comparatively little radiation of heat from the pure blue flame produced by the perfect combustion of natural gas." It is possible that is correct. That condition can be remedied by letting the blue flame heat to a white temperature a mass of fire brick. That is used in Pittsburg.

Mr. Chew: There are men who favor the fire brick idea to give you an incandescent mass, while other men experiment right in the opposite direction. Mr. Thompson is one of the men who believe you will get better efficiency from gas consumed without the incandescent fuel.

Mr. Blackmore: Mr. Thompson speaks of combustion, yet does not state clearly the difference between combustion at the burner and the necessary mixture before it reaches the burner. We all know if partially consumed air is mixed with gas going into the burner, it is impossible to get good combustion, yet a considerable portion of that may be used without interference with the combustion itself. This point he doesn't bring out clearly in the burning of gas.

Mr. Donnelly: My experience has been with heating water by gas, and it is remarkable to what a degree this has developed, it is possible with a copper coil to burn 24 to 26 cubic feet of gas per hour and transfer between 70 and 75 per cent. of the heat of the gas to the water, and at the same time obtain such perfect combustion as almost to detect no odor from the combustion.

I am interested in the point relative to the air surrounding the burner from the outside. That is a necessary consideration. You must have a space of free air to burn the gas after mixed in the most careful way. The development of burners for gas cooking ranges has brought out that point very clearly. The practice is to have small holes and separate them to just such an extent that the flame will be surrounded by free air. If the perforations are made too close the flames will come in contact with each other and it is apparent the combustion is not as satisfactory nor as good.

Mr. R. P. Bolton read his paper on "Steam Heating in Connection with Condensing Engines," printed in full in our January number.

DISCUSSION

Professor Kent: It seems to me the paper offers a chance of being introduced in practice and I hope Mr. Bolton will go ahead and introduce it in practice. It seems to me it offers great possibilities. You could have a condensing engine discharging steam into larger low-pressure mains, with radiators of larger surface than now used for high-pressure steam—say, similar surface as used for hot water—and carry the exhaust steam back into a tank connected with a condenser in which is maintained a vacuum of such temperature as necessary, then as the water got cooler you could raise the pressure in the tank and the steam passing through would be at a higher temperature. If you wanted less steam, you could shut off some of the exhaust steam, and instead of having it go through the pipes it could be shut off altogether. On the contrary, when the water was cool, we could open the vacuum and send through high-pressure steam. It seems a flexible system and one offering chances of economy. I think it is entirely practicable for factory heating, with an engineer in charge to look after the apparatus. It seems a very much cheaper plant in the first cost than the water circulating system and one which will offer as high economy as can be gotten out of any system.

Mr. Carpenter: I think the system is practicable. One time I had an opportunity to install a system on somewhat similar lines—in fact, the system is installed on practically the same lines as suggested here. Instead of having the plain radiator surfaces we had surfaces over which the air was forced for factory heating with a large fan.

Mr. Bolton: I have somewhat modified this for the sake of simplicity. In the case of the plant as shown, the economizer diverts a portion of heat and turns it back into the boiler. The wasted portion passes up the chimney and is shown as chimney work in the diagram of the station. The chimney is a portion of the boiler, and the chimney work should not be regarded as lost if the chimney is of an economical size and is not too large.

There is emitted from the boiler in the centre of the diagram so much in the form of steam, so much heat in the form of steam, and that as stated in the paper, under the best conditions, could not be more than 85 per cent. naturally, but theoretically and in a highly developed diagram it is brought out as high as 96 per cent., but this ignores the boiler.

You know the work of the engine, the work done on the piston, not the flywheel, but the piston, which is represented as passing upward on the right-hand side.

The heat passes to the atmosphere or condenser. In the case of the condenser, there is by means of that steam a certain addition to the useful work, because the condenser is removing the back pressure on the piston. That should be taken into account.

Finally you get the heat coming back and your feed. The whole system might be modified by introducing an open feed heater in line with the feed pump and economizer and bringing into it any drips, etc.

As regards the exhaust method of applying this apparatus, how far can you remove your condenser from your pressure and still carry the necessary degree of vacuum? In this case there was about 20 to 25 feet between the cylinder and condenser, 10-inch pipe.

This is the whole idea gathered from this suggestion of mine as to a heating system at low temperature. It must be, naturally, combined with some method of drawing the condensation straight down from the condenser and disposing of it.

It is not my intention to throw cold water on the system, which is actually working, but let me advise you to study the system and go further and see whether it is not possible to be done direct by steam on its way to the condenser. That is a point, of course, which will have to be figured out with more practical knowledge than I have at the present moment.

Mr. Almirall: I think we all know the importance of the pipe between the condenser and engine, and that the condenser should be placed as close as possible to the engine. When you extend that system so as to have several thousand feet of pipe and hundreds of joints, it is going to be a difficult matter to get that vacuum. You can probably get a vacuum, but I think it will require an unusually well-installed system, or else an unusually large air pump to keep the lines free from condensation and air so as to get a sufficient vacuum.

With the system spoken of by Mr. Carpenter it is possibly a different matter. He had a fan and the assumption is he had coils fairly close. The exhaust line was kept short; in this way he could, by the ordinary condenser, get as good a vacuum as by any other system. When you eliminate that and try to use the direct system, I don't think it is practicable.

Prof. Kent: I know of a big power plant not far from here where there is a central condensing system. Suppose an accident should happen to the steam pipe; the whole thing would be demoralized by throwing out all the condensers at once. If an explosion should take place, it would

blow the whole plant to pieces, while, if they were divided, the explosion would only throw out one portion of the plant. I think there are reasons against the centralizing of the condensing system.

TOPIC

"Grate and Heating Surface and Their Relation to Space and Exposure in Furnace Heating."

DISCUSSION

Mr. Chew: There exists in furnace heating, as in any other thing in the mechanical line, some relative proportions of the various parts. One square inch of grate surface should be provided for about one square foot and a half, or equivalent, of glass surface in residence work.

I think furnace men have gone too much on rule of thumb and have figured on the cubical contents of a building rather than the heat losing power. There seems to be a movement in the direction of designing work on the basis of an equivalent of glass surface, instead of saying one square inch of area in the hot air pipe will heat twenty-five cubic feet of space in the northwest room, on the third floor, or thirty cubic feet in the southeast room on the first floor, or thirty-five to forty cubic feet of space in the basement rooms. When it comes to heating large rooms, like churches, the relative proportions are much different; it will vary from one square inch to something like eighty to one hundred cubic feet of space.

There is one other point. You can say one inch of grate will take care of one and a half feet of glass surface, but, if you don't know how much coal was burned the value of good construction is lost sight of.

Mr. Kitchen: In the furnace I am putting up now I provide sixty square feet of heat transmitting surface to one of grate surface.

Mr. Oldacre: I don't think anything applies, as far as the relation of grate surface to the heating surface or heating surface exposure, except what applies to any steam boiler or heating surface exposure, except what applies to any steam boiler or hot water heater. There may be a larger amount of grate surface and a small amount of flue surface, and an apparently small amount of heating surface. These are all matters of construction, but the heating apparatus, that has the largest amount of heating surface in proportion to grate surface, is the most efficient. In a general way, I should say the heater which has anywhere from forty to sixty feet of heating surface per square foot of grate surface is more efficient than one not having over eighteen or twenty.

Mr. Quay: In furnace heating I always consider the circulation of air. It is as necessary as the circulation of steam and hot water. There is as much in the fresh air intakes of the furnace and return flues as in any other part.

Mr. Kent: In conversation with Mr. Richardson a year ago, he mentioned this trouble of getting rooms warm. He said, "You will have no trouble if you take a return flue from that room and carry it to your furnace." What surprised me about that statement was, I never heard of it before. The second time I have heard the idea is in this paper we have had to-day.

Mr. Lyman: That method of returning air is very commonly employed in New York State. All through the northern section of New York it is the customary method to take two or three or four return pipes from the rooms, especially the rooms hard to heat, and carry them back to the furnace.

Mr. Oldacre: What would be the effect on the air of the rooms of a house as regards humidity, with the circulating system or with a system where the air is taken entirely from the outside; would there be a higher or lower relative humidity?

Mr. Kent: It would depend on the humidity out of doors. If you had the air at a certain humidity in the house, at 70 degrees F., and that air was circulated round and round, it would stay there. Let some of that air out and take in air from out of doors that contains a smaller quantity of moisture per cubic foot or pound of air, then you would get less humidity. If the air out of doors contained more water per pound, you would have more humidity.

Mr. Oldacre: What I meant was, taking two plants under the same conditions—one with the circulating system and the other with the air from the outside—with the same outside conditions as regards humidity of the air, and, we will say, no vapor pan.

Mr. Kent: If you have air coming in from the outside, there must be escape for the air out of the house somewhere. The humidity would be increased if you didn't have any outside air, for generally you will find more moisture in the house than out of doors, due to the presence of people in the house and possibly some evaporation going on.

Mr. Barron: The ordinary furnace, the ordinary heating boiler, generally has but half the heating surface or grate surface power boilers have. The average heating boiler has four feet of prime surface to a foot of grate. The reason the furnace men and the heating boilermen won't disclose how much heating surface they give to a square foot of grate is, they know the surface is so inadequate they don't want to disclose it. We know heating boilers burn more coal in proportion than power boilers.

Mr. Oldacre: Most manufacturers, I think, are perfectly willing to give data, but it is a lot of work to measure up different boilers and furnaces when you have lots of them, and you don't want to stop

to do it. I know of the science of their business. They are at a loss.

Mr. Bolton: It is to be hoped furnace manufacturers will make some arrangement by which the moisture can be added in some other way than by the present water box. I have spoken to a gentleman who tried to introduce moisture at the register. He placed a pan there and some cotton cloth, as an auxiliary arrangement to draw the water to the air. He evaporated ten times as much water into his house as with the previous arrangement of the box. He maintains that as soon as this apparatus stops and he goes back to the water box he can taste the feeling in his mouth.

Professor Kent: The consulting engineer has not the data. The best men today putting in furnaces are forced to rely upon what others have done.

On motion of Mr. Quay the president appointed the following committee of three to collect furnace data: Professor Kent, Mr. Chew and Mr. Oldacre.

TOPIC

"The Requirements of Heating Boilers Using Bituminous Coal."

DISCUSSION

Mr. Cary: I have drawn on the blackboard what represents two vessels, a small cylindrical leg and an outer one, like cylinders found at the bottom of tubular boilers. Inside of this is the fire grate. When this is to be used as a steam boiler the upper part is used as a steam chamber. When it is used as a hot-water boiler, of course, the steam space is not required. Instead, the outside vessel is connected in such a manner as to allow circulation to pass from one to the other. I have shown the connection between the inside and outside vessels by means of a series of pipes running from the top of the boiler.

This is another method of connecting the boilers. Proper provision is made for blowing off the deposits in the water legs, and the construction is simple. After fire is started and sufficient coal is charged, as this coal is constantly surrounded with water on all sides its temperature is kept down below the point of ignition, so the fire will not burn back and the coal will not burn at all until delivered below the water line. This is a very essential feature—to prevent the fire from burning up into the magazine.

As the fire burns on the grate beneath this magazine the coal wastes away by combustion and green coal drops to supply sufficient fuel to the grate. In order to prevent burning gases from rushing to the point of discharge, through the water leg to the flue, the flue is located directly at the rear. If we could look through this section we would find the flue open at the rear. In order to prevent burning gases from rushing directly to the point of discharge, through the water leg, directly down to the flue, cast iron baffles are placed around the boiler, which don't continue the whole distance around, but are broken so they pass par way around, and there is an open space for the gases to plunge down, so as to make them travel three times around the boiler before they are finally discharged into the chimney. The rate of combustion can be controlled by an automatic regulator.

Tests have been made with this boiler, using Illinois coal, running as high as 40 per cent. volatile matter, and it has performed its functions most satisfactorily, requiring no more attention than an anthracite boiler, and without emitting any objectionable smoke.

Mr. Kitchen: Are these baffles necessary?

Mr. Cary: Without the baffles you would not have a sufficient run of gases to absorb the heat. The temperature of the gases is maintained by the hot brick surrounding the boiler, and the gases, giving up their temperature to the water, constantly being passed around the outside of this water, reach the point of outlet at a comparatively low temperature.

Mr. Crane: I used a number of boilers in house work and in larger work and they have given good satisfaction. It seems that very little soot accumulates on the flue above the baffles. Looking back through the front and looking sidewise are small flue doors from which you can get access to both flues. I think it requires very little attention with the soft coal we use in Illinois, which everyone knows is full of soot and dirt.

Mr. Cary: We want more boilers of this kind. We have had one hard-coal strike and been in lots of trouble. I tried to burn soft coal and got along very well until my chimney blew up and I had to burn zinc to drop the soot, and had all sorts of trouble, which I won't have again. The cost of hard coal is not going to be any less than it is, and the larger sizes, being more desirable, are getting more and more expensive. In power plants, as well as heating plants, we want to burn bituminous coal.

Mr. Shanklin: We have used these boilers in our practice in West Virginia, Ohio and Virginia, and the only objection found was that in using smokeless coal it would coke in the magazine and hang up, allowing the fire to go out. Where we used screenings or coal that would not coke we have carried the fire twenty-four hours.

However, owing to the fact that basements in our section of the country are very damp, the boilers being made of steel plate and having pipe connections passing through the brick walls, these plates and pipes rust out and give us considerable trouble in repairs.

I think, however, that it is a very economical boiler for soft coal use and

can be made to last and prove a very satisfactory boiler.

FOURTH SESSION—THURSDAY MORNING

Mr. Mackay read a paper by Mr. A. B. Reck, entitled "Experience With Radiators in the Top Story of a Building," printed in full in our January number.

DISCUSSION

Secretary Mackay: The trouble in this case has been the same as in other cases where estimators get the floor plans of a building from the architect and know nothing about the ceiling.

He assumes there were air spaces, when in fact there were none but the exposed wall of a building. He made the mistake of not making proper allowance for his exposed ceiling or roof. He put it in at the ratio that he employed for unfinished attics above and found he didn't have an unfinished attic above. That simply changed the ratio from an unfinished attic to an exposed wall ratio, and necessitated increasing it just as much as that ceiling space called for. He acknowledges his mistake, shows the correction, so it doesn't leave much room for argument.

It is the leaving out of these necessary points and not getting sufficient information that makes failures of heating apparatus carefully calculated to suit requirements that don't exist.

Mr. Quay: In one large building in New York we figured originally on an investment of probably five or six thousand dollars for heating the dome, and the amount prevented the owners from accepting the proposition. They were not going to use the top story for some time, and took chances on it without additional radiation for the dome.

It has been found that the radiation was not necessary. We figured enough for the other parts of the building, but not the dome. Due to the sunlight and the design of the dome, I presume, the room has been comfortably heated in the coldest weather.

What is the experience of members relative to heating domes and skylights over buildings, providing they are designed in such a way as to give the best light at all times of the day?

Mr. Barron: My experience with domes or skylights on top stories is that the heating engineer usually puts in a great deal of heating surface that generally is not used because of the tendency of the heat from the lower floors to reach the top floor. I think it is due not so much to the sunlight as to the warm air going up from below. That is often figured on, and I, in the past, have figured on heat coming from the lower floors.

Secretary Mackay: There is a difference between an exposed wall which always exists and a skylight or glass exposure which is helped by the sun. Greenhouse men fire their boilers only at night and bank them in the daytime, saying they have more heat than they require from the sun through the glass construction, while at night, when they have no sun, they require all the heat they can get, having the coldest imaginable constructed building. The condition Mr. Reck ran up against is a permanent condition, an exposed wall not helped by the sun.

Mr. Barron: It occurs to my mind the sun does affect the roof of a building, assuming it is a plain roof and without air space. The sun beating on that certainly changes the temperature.

Secretary Mackay: In ordinary constructions there is an air space, and air is the best non-conductor we can get. As a result, we don't get any advantage of the sun through that air space which we would get through glass exposure.

Mr. Barron: Roof air varies in different cases. In a church we never put coils or radiators around the dome.

Secretary Mackay: I had some experience with a church building in Boston, I believe the second largest church in Massachusetts. They had steam heating apparatus in there for a number of years which was not satisfactory. In addition to the immense amount of coal consumed was trouble from the dome, which was 111 feet high and 50 feet in diameter, with windows and glass on top. In front of the altar they got a continuous downward current, and more objectionable there than at any other point because they had less opportunity for placing radiation there.

I put what I call a solid apron of heat between the altar and the dome, 70 feet from the bottom of the dome and 111 feet from the top. They never experienced any further trouble from the draft.

One of the principal reasons why I didn't put a coil around this point was that I would have been carrying a water pressure on my boilers of 150 feet in height, or something about 65 to 70 feet of steady pressure on the boilers. As it is, I am carrying about 25 to 30 feet of hot water instead of 100 feet.

Mr. Kent: Were the radiators on the floor?

Secretary Mackay: Direct radiators on the floor. You can stand at the altar and with 80,000 feet of radiation you cannot see a radiator. They stand below the book boards, finished in the same color.

Mr. Kenrick: I had a problem several years ago in fitting up a bath house—tank 86 by 26 feet. Over the tank a skylight 60 by 30. I had three problems to study: one to heat the building, another to heat the water, and to provide that when a party made a plunge and

came out of the water into the open air he would not be chilled from the skylight. I installed about 1,800 feet of water pipe in the shape of coils around the skylight.

Mr. Quay: It seems to follow that there is necessity for radiation around the skylight. That depends on the design of the skylight. I heard from a man who works in a lithographic establishment on the top floor where the skylights were designed, as he says, to get the best light at all times of the day. He says that without any radiation in the room and with the outside temperature at zero, the men work in there in their shirt sleeves, and on very important work that requires warm hands. He says at one time he noticed the temperature was 85 in the room, while it was zero outside.

Mr. Barron: The lithographic establishment I imagine he refers to employed a great many hands, and, if they are pretty stout men, they give out a good many heat units. That possibly helped the sun from the outside. All these things have to be considered. It depends on the number of individuals in the room and the conditions of each particular case. I have found, as Mr. Quay did, where coils have been provided for the top story that it was not necessary to use them even in the coldest weather.

Mr. Munroe: I have been waiting for some one to refer to the first three lines of the last paragraph of this paper: "In the building referred to the radiators in many rooms on the top floor have now 66 per cent. more heating capacity than in the rooms on the second floor, with equal windows and wall area, without being larger than necessary." That seems abnormal. I have been in a good many top stories of houses but never used any such proportion as that. I think there must have been some defect in circulation—the radiators were not doing their proper work. Of course, we have to make sufficient allowance for the top floors of the buildings over the floor immediately below it, to overcome exposures if there are any. Outside of that, as a rule, the top floor of a building can be taken care of, in my experience, with the same radiation that is on the floor immediately below it. As a rule, the top floor has one or two feet lower ceiling than the lower floor, but that doesn't always follow.

Mr. Brennan: I think that the apparatus must have been faulty in construction. If he had 66 per cent. more radiation on the upper floor than on the other floors there certainly must have been poor circulation of water.

My experience with hot water has been that it goes up very easily, and with most of the apparatus I have constructed I found it hardest to circulate water on the first floor, and not on the upper floors, and that a radiator would heat about 10 per cent. better on the upper floors than on the lower floor, and, proportionately, the second floor would heat better than the first, the third better than the second and the fourth better than the third. It is my opinion that the water was not as hot, or there was not as good circulation on the upper floor as on the lower floor, and that the trouble was to a certain extent due to that cause and not so much to the cooling surface of the roof.

Mr. Vrooman: Professor Kent offered a suggestion that we have a discussion on what relation skylights have to radiation, the paper to come up at the next meeting, but I propose that we add the word "ceiling," because in almost every rule you take up given in books you will find that they consider area or exposed glass surface, or exposed wall surface, and the word "ceiling" is almost invariably left out.

Mr. John S. Brennan then read his paper on "The Circulation of Hot Water," printed in full in our January number.

Mr. Cary: Mr. Brennan has shown, perhaps properly and perhaps not, the efficiency of the radiator by taking the temperature entering and the temperature leaving. In the first place, where you have a very small difference, such as one or two degrees, as I see there is a small differential here in the old style radiator; it is not at all infrequent to find temperatures varying to that extent. I want to know whether Mr. Brennan carefully compared the temperatures.

Mr. Brennan: I did.

Mr. Cary: That is a necessary step. Suppose we have a difference of two degrees between the inflowing and the outflowing water, or, there may be five or six degrees, yet at the same time the radiator may be giving out the same quantity of heat. The quantity of heat delivered depends on the quantity of water flowing through the radiators.

Do you know the quantity of heat that the same number of pints of water flowed through each radiator during the time of the test? If you do, the difference shown by the temperatures will give the respective efficiency of the apparatus. If the circulation is slower or faster in one case than in the other, we don't get reliable information.

Mr. Brennan: The feed and return ends of the improved connection were a good deal hotter than the old style connection, and the reason I picked out this peculiar difference, having a large amount of heating surface in one radiator and a small amount in the other, was to show that under the worst existing conditions the circulation was still better.

Secretary Mackay: Mr. Brennan says that "the water becomes denser as it cools off, and it therefore outweighs the warmer

and lighter water and pushes it to the top of the apparatus." Now, in looking at these two cuts and in considering the general application of these apparatus, I cannot understand why this clause would not apply to Fig. 1 as well as to Fig. 2.

Then he refers to the old style of radiator and the new style of connection, which he speaks of here. I want to correct him in that. In the first construction of radiators for hot water we considered that it was necessary to block off the first loop of the radiator at the bottom so the water would take its course into the radiator, up the first loop to the top, as Mr. Brennan has shown in Fig. 2, then along the top and down along the other loops to the return. That gave what we considered positive circulation, and would do away with the possibility of short circuits and all those evils we had to meet before we could successfully apply a hot water heating apparatus.

I conducted some tests at the Griffing Iron Works, some eighteen years ago, where that question was under discussion in the old Bundy radiator. We put these up in a shed and connected them with the hot water heating apparatus.

We found we got equally good results, or if anything better results, by allowing the water to ascend in as many loops as it would and descend in all the others. The radiator we found was merely a tank that held the water, but if you introduced heat at any point it rose to the highest point and went down without the necessity of any special device.

We had a peculiar experience there which I think worth while mentioning. In cold weather, when we would start up the apparatus, when the temperature out of doors was, perhaps, down to around zero, it was impossible to get any circulation in these radiators until you had completely filled them with water, and before they were completely filled they were frozen solid. We had to go around with torches over the return pipes and radiators before we could get circulation.

In the new construction, where you enter the water at the bottom and take it out at the bottom, regardless of whether you take it out at the same end or the opposite end, so long as there is one-eighth of an inch of water in the pipes, or sufficient to fill the bottom tube, you have circulation and the bottom is as hot as the water in the boiler, less the loss of heat between the boiler and the radiator. We have no trouble from freezing, no trouble from the circulation, and positively better results. I attributed it to absence of the friction which was caused by putting in a device to compel the water to take sharp turns.

Now, there are two different ways of putting it. One says, heated water, being lighter, will flow to the top and compel the heavier water to go below. The other says that the heavier water going below will compel the lighter water to go up.

It is something in common practice in every house in the United States that has plumbing in it with hot water circulation. Without the need of any special device the water heated in the water-back will go to the boiler.

It was originally thought to be positively necessary to enter the water at the top of the coil or radiator and take it out at the bottom on the opposite end. Some trouble from freezing took place then. In making a number of experiments with hot water circulation, I discovered it did not make any difference whether the flow was taken in at the top and out at the bottom, on the same ends, or opposite ends. I also discovered if conditions were such that you could not get across to the opposite end, you could take the ordinary radiator and put two connections on one end. I made up a special fitting of this kind some years ago. I would screw this fitting into an ordinary radiator, putting an ornamental plug in the opposite end, which would make the connection slightly larger, and as large as 1½ inches at times. Naturally, I did not get a full area, but I find I obtained equal results as with opposite ends, and it did not short circuit. It had a division, but this was not a necessity. It laid flat so the flow and the return went in and came out on the same level. I found there was not any difference with the same radiator, whether connected at the top or at the bottom. Mr. Brennan makes another statement that in Fig. 1 a better circulation is obtained in "A" through "G" and "F" than would be secured through "C" and "B." I do not know what provision he made for the exhaust of his air along the top line, but his results are exactly opposite to those obtained in the average hot water plant. I have found, in hot water circulation, that I can, with an overhead supply, reduce the area of my mains from 20 to 25 per cent. less than with the under supply. I think this will be the average experience of everyone doing hot water heating. There no doubt have been some peculiar conditions in connection with Mr. Brennan's tests. He did not extract his air properly, or something of that sort. Air, of course, is the worst enemy that we have to contend with in hot water circulation, and the presence of it will as effectively stop circulation as if you had an expensive gate valve.

Mr. Lyman: What has been your experience, Mr. Mackay, in relation to sizes of pipes? Possibly the connections shown in Mr. Brennan's paper were too large on the first radiator.

Secretary Mackay: Larger than it is the general practice to place them.

Mr. Brennan: There are objections in most all kinds of heating apparatus. The overhead system will not circulate until all the radiators are completely filled with water. I had a case of a four-story building in the country, with the overhead sys-

tem, where we had to pump water, and before I could get the water to the fourth story I had pretty nearly all the radiators frozen up. The freezing up of radiators in a new building would be obliterated to a certain extent by this connection, because where you use radiators for temporary heating it is usually the practice to connect the radiator with pipes, extending the radiator out so that the workmen can get behind it to do the finishing.

The tests which I give show simply an idea of mine. Whether the overhead system will head or take more heat units from the fire than the system in the basement is what I want to get at.

Professor Kent: I wish to ask Mr. Brennan about the paragraph: "This is often proved by the fact that the lower portion of the radiator is much hotter than the uper portion, while it should be the reverse." I do not see why it should be the reverse. If hot water goes in at the bottom it can get no hotter when it gets to the top without receiving heat from some source. In order to make this test complete we would have to have meters on the pipes to show the amount of water going through the radiators as well as the temperatures.

(The question here arose as to whether Mr. Brennan's paper should be supplemented by additional data before being added to the Society's records, which brought out the point that once the Board of Governors has accepted a paper it cannot be omitted from the records.)

TOPIC

"What Is the Greatest Height of a Building Which Can Be Successfully Heated by Gravity System of Hot Water, Taking Into Consideration the Pressure on the Apparatus by the Height?"

DISCUSSION

Secretary Mackay: While I have not any positive information as to actual measurements in feet, I would mention that Baker, Smith & Co., some four or five years ago, installed a hot water heating apparatus in a ten-story and basement building in New York; the boiler being located in the sub-cellar. The stories averaged 15 feet, so that the building would not be less than 135 feet in height. It was a question with the contractors regarding the construction of the valve that would stand the pressure, without leaking, under that excessive head. While they felt the boilers, mains, etc., would stand it, they were in doubt as to the movable parts. They expected leakage there, but as far as I know they have had no trouble from that. In the Polytechnic Institute an apparatus has been in use for twelve or fifteen years, where the height of the top of the water in the tank is 120 feet above the boilers. In the Odd Fellows Business Block, New Bedford, Mass., a heating apparatus has been in use for fifteen years. The building is six stories and the tank is up in a tower one or two stories above. From the tank to the boilers is something like 110 or 115 feet. There are lots of fairly high buildings, five, six or seven stories, being heated from year to year without any trouble. I understand the Mormon Temple, in Salt Lake City, is a very high building and heated by hot water.

Professor Kent: What do you think of Mr. Brennan's statement that he found the radiators cold at the top and hot at the bottom, when he used the old connection?

Secretary Mackay: I have never found that to be the result unless caused by an accumulation of air in the top of the radiators.

Professor Kent: Is there not an automatic air valve that can be used?

Secretary Mackay: There has been, but there is one point where the overhead system gets rid of it. We come down with one pipe instead of two, connecting into the radiator at the same end, and frequently back to the same main. The system is relieved of air at the highest point, whereas, in the ordinary apparatus you have to have an air valve. It is not a matter of much manipulation, except on the top floor of the building. The air valves do not have to be operated the entire winter. There are different ways of doing it. Some pipe the apparatus in the ordinary way and then take an air pipe from the top of each top floor radiator, which is not as objectionable as taking from all radiators. Some of these pipes are run at a point where they freeze, and might be broken by expansion. The ordinary gate air valve is used where a top feed and bottom return are put in. The air valve is located at the opposite end, more as a guide in filling up the apparatus. I use exactly the same thing in indirect hot water radiation. The simplest and best way to pipe it is to pipe it similar to low pressure steam. It is simpler, better and surer, and always insures the radiator being in operation as long as there is fire in the heater and water in the apparatus. I have frequently used the same main for indirects as for the directs, but the objection to that plan is that the upper radiators will draw water from the lower ones. The customary practice has been to run separate mains for the direct radiators from the boilers and separate mains for the indirect, so that they can be valved off separately and so that the upper radiators could not get water intended for the indirects, consequently insuring a more uniform distribution of the heated water. Sometimes the entire first and second floors are heated by indirect radiation and the third floor by direct radiation.

Mr. Munroe: Isn't is as practicable in a system where the main flow and return are in the basement, to make connection

to the radiators at the top and let the water pass on out through the riser, venting the top floor radiators with air pipes to the tank?

Secretary Mackay: Yes, you can also get rid of the air for indirect radiators in the same way.

Mr. Munroe: Below the mains, and allowing the air to pass into the riser on the top floor?

Secretary Mackay: There is a possibility of breakage from expansion and contraction, and there is a possibility of robbing your first floor radiators which are important. Taking out the hottest water from the radiator into the riser accomplishes nothing, except to draw the water away from first floor radiators. The trouble from air has been on the upper floors of the buildings, and while there is a certain amount of air in the water, all of that goes to the top. It is there where your trouble is from air, if it exists at all, and not on the first floor.

Mr. Munroe: I am taking the feed connections going to the top where the return connection goes under the bottom. The air will pass up through the feed connection until that radiator is filled with water.

Secretary Mackay: You will have the same trouble.

Mr. Brennan: The connection that Mr. Mackay has described and where he claims the circulation is connected to both ends. I have experimented with. In my connection, the partition is extended to the first push nipple. It is not so tight that it excludes water from passing through into the radiator, but this partition was arranged so that it was about midway of the first section of the radiator. The test was then made and the circulation in this radiator was from 10 to 15 degrees cooler than with the old style of connection.

Mr. Kenrick: In Mr. Mackay's tests did he notice any difference in the time of heating with radiators, whether the flow conection was at the top or bottom, and what was the difference, if any?

Secretary Mackay: We found it made a difference of from 10 per cent. to 20 per cent., possibly, in time. That is, the radiator without the division heated up 10 per cent. to 18 per cent. quicker, and we attributed that to the trouble we all experience in hot water heating—friction. Mr. Cary makes a drawing of hot water circulation. Those who have had experience with hot water heating will agree with me that what is right and necessary for the circulation of water in a steam power boiler is not always right or proper in a hot water heating apparatus. The statement has often been made that it is impossible to hold cold water above hot water in a hot water heating apparatus. Still, it is done time and again. We find, in our experience, that water passing from a radiator will get into the return pipe at a higher temperature than the water further along the line in the same return pipe, and will effectually hold the circulation in check, causing the radiators higher than the boiler to become cold, although a free flow and return main of ample size to supply these radiators was in place and graded upwards from the boiler to the radiators.

FIFTH SESSION—THURSDAY AFTERNOON

At this session, following the reading of Professor Carpenter's paper on "European Methods of Heating Fifty Years Ago," and the discussion of other topics, the installation of the new officers took place.

Professor Kent, the President-elect, was escorted to the chair by Professor Carpenter and Mr. Crane amid applause.

On motion of Mr. Jellett it was voted that the Board of Governors be instructed to prepare and have engrossed a set of resolutions embracing the sentiments of the Society towards Albert D. Wray, New York; Loyal L. Davis, Glens Falls, N. Y., and Professor Cole, of Albany, N. Y., in appreciation of their services in securing the passage of the Ventilation Law of New York State.

The remaining topics on the programme were then announced:

TOPIC

"Methods of Heating Large Bodies of Water for Public Baths and Industrial Purposes by Steam or Otherwise."

DISCUSSION

Mr. Cary: I would like to describe a very simple and effective apparatus. It consists of an ejector, containing a space for steam around a central tube through which the water passes. When the steam is turned on it rushes out of the concentric opening, drawing the water after it. With only a ½-inch steam connection and a 1½-inch water inlet, it will raise 100 gallons of water 50 degrees in 3 minutes. With a 1-inch steam pipe connection and a 2½-inch water opening, it will raise 100 gallons 50 degrees in 1 minute. It is especially adapted for long tanks. The pipe screwing into the inlet end can be extended. If we have an especially long tank it can be extended to the opposite end. The circulation is very rapid and the heating of the water occurs without escape of steam. It is not new, but has been on the market a number of years.

Mr. Kenrick: What pressure of steam?

Mr. Cary: Eighty pounds.

Mr. Kenrick: Were these appliances placed on the inside of the tank?

Mr. Cary: Submerged entirely in water and near the bottom of the tank—possibly a few inches above the bottom of the tank.

Mr. Kenrick: Isn't there a possibility of the bathers getting burned?

Mr. Cary: I haven't applied it to a tank for that purpose. If there were any danger of that kind I would construct on either side of the tank a small duct, and place the heater inside of that, so as to have circulation along each side. The bathers could not get into contact with the live steam. Very little live steam escapes through the outlet.

TOPIC

"Proportion of Grate Surface Required for Different Fuels."

DISCUSSION

Mr. Cary: In ordinary steam plant practice we have anthracite coal which is practically fixed carbon. It might be considered so for illustration. We are succeeding in burning 15 pounds of such coal per square foot of grate. With bituminous coal, as the volatile matter increases you can increase the coal burned per square foot of grate. The fixed carbon will remain practically the same. The quantity of ash contained in the coal would modify it materially.

President Kent: We had a paper from Professor Carpenter in which he spoke of four pounds of coal to one square foot of grate surface. Mr. Cary said he knew of 40 pounds being burned to the square foot. It required ten times as much grate surface in the one case as the other. In regard to bituminous coal, they are getting results with 15 pounds of bituminous coal to the square foot of grate surface per hour, and in locomotive practice 100 pounds per hour. It does not depend on the quality altogether, but the capacity for burning it, and usually the necessity you have for burning it. If you have only so much real estate to put grate surface on and time to burn so much coal, you would put in forced draft. In househeating they burn 4 pounds of coal per square foot per hour.

At this point several of the topics were grouped for discussion. Mr. William C. Vrooman explained an idea proposed to him of heating a high building with hot water without excessive pressure.

Mr. Vrooman. This might be done by dividing the system into sections (Mr. Vroom illustrated his idea by a drawing). The principle is the same as is used in plumbing where a double boiler is utilized, and one boiler is connected to the tank and the other to the water back.

TOPIC

"The Increased Efficiency of Heating Apparatus, Using a Fan."

DISCUSSION

Professor Carpenter: I made a number of tests, showing the amount of heat given off, the radiating surface and various other conditions, and it is pretty fair to assume the efficiency caused by the fan was about 5 to 1, or varying according to circumstances, fro 7 to 3.

President Kent: Professor Carpenter says heating surfaces will give 250 B. T. U. per square foot of radiating surface per hour, at a temperature of 70 degrees, or something like that, without a fan.

Professor Carpenter: With cast iron radiating surface.

President Kent: If you use a blast you might double the effectiveness of the heating surface. And by increasing the blast, increase the effectiveness up to five times that?

Professor Carpenter: That is the idea; yes.

Other matters brought up at this session were the report of the Committee on Tests and the matter of a Question Box to be conducted by the Society. The discussion of the Test Committee's report developed the fact that although comparatively little had been accomplished, the results obtained were of such value to the Society that the committee should be retained. The matter of a Question Box was referred to the incoming Board of Directors.

President Kent announced the following committees for the next year:

COMMITTEES, 1905-6

COMPULSORY LEGISLATION

Andrew Harvey, Chairman.
C. B. J. Snyder.
Stewart A. Jellett.
T. J. Waters.
B. H. Carpenter.

STANDARDS

J. J. Blackmore, Chairman.
J. H. Kinealy.
H. D. Crane.
Wiltsie F. Wolfe.
H. J. Barron.

TESTS

Wm. G. Snow, Chairman.
R. C. Carpenter.
A. A. Cary.
J. A. Almirall.
H. H. Ritter.

Mr. Feldman then read extracts from a paper read by Dr. Henry Mitchell Smith before the Medical Society on "Indoor Humidity."

On motion of Mr. Kenrick the meeting then adjourned.

NATIONAL ASSOCIATION OF MASTER STEAM AND HOT WATER FITTERS

We understand from the *Official Bulletin*, of the National Association of Master Steam and Hot Water Fitters, that the organization is considering that hotbed of effete aristocracy, Newport, R. I., as the place for holding its approaching annual convention. The choice is said to lie between Newport and Niagara Falls.

Heating Engineers' Dinner, Hotel Astor, Jan. 18, 1905

The annual dinner of the Society has become an important feature of its meetings, and on this occasion the dinner and the menu easily excelled those of past years. One hundred and sixty members and guests were seated at the seven tables, with the officers seated at a special table running across the ends of the other tables.

At the close of the dinner, President Harvey addressed the guests in a nice little congratulatory speech and called upon Prof. R. C. Carpenter, of Cornell University, to act as toast master for the evening.

Professor Carpenter made a few remarks and then started on a geographical program, calling for responses from representatives of different cities.

R. P. Bolton cleverly responded for New York, in which city he thought most things began or ended around the table, and he said that in absenting himself from home for that evening he had explained that he was to meet the heating engineers.

He considered New York a city of pipes—we have long traveled up and down in our office buildings through pipes, and now we travel up and down town in a big pipe, and he thought this might be considered the age of pipes—steam, water, gas and other kinds.

A. E. Kenrick responded for Boston, and in the course of his remarks alluded to the fact that Massachusetts was the first State to compel ventilation of schools and public buildings. He was proud of Massachusetts for setting an example so good that New York was glad to follow it.

C. V. Kellogg spoke for Chicago, for which he had a good deal to say. He made the point that sixty per cent. of the house heating goods sold in this country are sold from Chicago. He thought that if the headquarters of the Heating and Ventilating Engineers Society had been in Chicago the membership would have been more than doubled.

Mr. Kellogg alluded to Chicago as commonly designated "The Windy City," but said that he never met a real, able-bodied breeze until his goings and comings brought him into the vicinity of the Flatiron Building.

J. S. Brennan being called upon to speak for Milwaukee, made a strong plea for the summer meeting of the Society to be held in that city.

S. A. Jellett, of Philadelphia, spoke for the Quaker City, which, as he reminded the Society, contains ten per cent. of the Society's membership. Mr. Jellett referred to Benjamin Franklin as an early heating engineer. He also stated that the first steam heating installation in this country was that in the Eastern Penitentiary at Philadelphia, seventy odd years ago.

The toastmaster then closed his atlas and called upon Senator A. A. Wray, esteemed by the Society for his services in connection with ventilating legislation.

Mr. Wray responded with a most entertaining speech, in the course of which he stated that such aid as he was able to render in the passage of the compulsory ventilation bill gave him more satisfaction than any other work done during his public life.

William G. Snow spoke on "Contributions to Education Made by Engineers," in the course of which he thanked the editors for the records preserved in convenient form for future reference. He mentioned that a man who lately founded a technical library considered the best thing to start with was a set of the Proceedings of the American Society of Heating and Ventilating Engineers.

Hugh J. Barron, speaking on "Standards," thought that standards in general were difficult to establish, but that the dinner revealed a standard of good fellowship, which he considered the highest of all standards.

W. F. Wolfe responded to the toast on "Tests."

C. B. J. Snyder, speaking on "Compulsory Ventilation," regretted the necessity of using the word compulsory in connection with ventilation. It ought not to be compulsory but spontaneous. At the same time he told something of the manner in which the New York State bill was put upon the statute books as containing a possible suggestion for use in other States.

William Kent, the newly-elected president, spoke of "The Future of the Society." He thought the past progress good enough, so that the Society's future was assured if it kept right on doing as well as it has done heretofore. He urged members to make investigations on various subjects and to have that in mind all the while, so that when anything came up that would be of interest it should be investigated and a complete record prepared.

F. K. Chew spoke for "The Press," but instead of extolling the press, said that he would "stick to regular business and give news." Feeling that many failed to realize the good work achieved by the Society, he gave various specific instances of results accomplished and work under way.

The Art of Heating and Ventilating, as Practiced Fifty Years Ago*

By R. C. Carpenter

It had been the intention of the writer to give an extended resumé of several early works on heating and ventilation in order that opportunity might be given to contrast our present practice with that common fifty years earlier. A press of other work has prevented me from giving the necessary time to this article to make it of much value historically, and I can only hope to suggest in the short time which I have had for the preparation some topics for discussion to those who are qualified to discuss the present methods as compared with those used much earlier.

I can at best hope to make only a few general observations.

One conclusion which I think can be stated as contrasting the work done in this art one-half century earlier with that to-day is this: The improvements which have been made are principally in the line of manufactures, such as can be comprehended under the heads of materials, workmanship and art. There have not been great or radical changes in methods and systems of heating and ventilating, so far at least as the descriptions in the various books at hand can indicate. Fifty years ago there were few manufactured articles on the market in any country of the world for the erection of heating and ventilating systems, and it was necessary in a great measure to use articles of special design and manufacture.

Thus, for instance, if you refer to the work of Thomas Tredgold, published in London in 1836, you will find that at that time a steam heating engineer would have been in possession of approximate methods of computing the loss of heat radiated from buildings and of corresponding methods of computing the necessary size of radiating surface to supply the required heat. You will find, however, no standard or manufactured forms of heaters or radiating surfaces existed, and that, consequently, it was necessary for the heating engineer to also be his own manufacturer and designer and construct his own heaters, radiators, etc.

Tredgold's book states that steam pipes may be made of cast iron, lead, copper or wrought iron, but in practically all the examples cited, cast iron pipes are shown. Regarding the various joints for pipes, Tredgold gives preference to the flanged joints packed with a flat plait of slightly twisted hemp yarn, which has been previously saturated with stiff white lead paint. He also speaks of making joints by facing the flanges and using for packing a strip of tin. He had even found out at that time that lead was too compressible to be used instead of tin for this purpose, as it contracts permanently. He also speaks of the use of iron cement for flange joints. The use of spigot and faucet joints, which were then common for water pipes, he states, are not well adapted for steam pipes because there is no provision for holding the parts together.

Tredgold states that wrought iron pipes are joined "by making the lengths that are to be put together each to screw into a piece of pipe of larger diameter," which is practically our method at the present day. For the purpose of taking up expansion, Tredgold recommends that a drum of thin copper be employed, which may be compressed or extended without injury, and states that such drums were used in steam pipes supplied to warm a lecture room at the Royal Institution. He states that the expansion may be taken up by connecting the pipes to a short length of smaller pipes arranged to slide in a stuffing box, but the drum he considers preferable.

Tredgold's work shows that he was well acquainted with the design and construction and use of steam traps for removing the water condensation, two kinds being illustrated, one a float trap, which is perfect in every detail, and the other a siphon trap, made by connecting the return pipe with a U bend, of which the legs were long enough to overcome the pressure due to steam.

The boilers shown in Tredgold's work are of both cast iron and wrought iron. The cast iron boiler is of spherical form, without internal tubes, and it is set in brick casing so arranged as to cause the heated gases to encircle the sphere in a spiral path. The wrought iron boiler is of cylindrical form, without any internal flues, and is set in brickwork so as to be encircled by the heated gases. The boiler is provided with a safety valve opening inward to prevent the formation of a vacuum, and a combined manhole cover and safety valve opening outward, the manhole cover being held on by a bar designed to give way should any excess of pressure come upon the boiler.

In the steam heating system shown by Tredgold, the condensed water is usually returned to the boiler by gravity, his direction for piping being as follows: "The steam pipes proceeding in the nearest course to the highest point where steam is required and then descending to the lowest, from which the small condensed water pipe returns the water to the boiler. Unless you want heat in the places through which this small pipe is to pass, let it be surrounded with slow conductors of heat so that as little as possible may escape."

*Read before Eleventh Annual Meeting of American Society of Heating and Ventilating Engineers.

He states that when the boiler is not sufficiently low to receive the return water, then it may be necessary to adopt other schemes, and he describes a very ingenious method of raising the water of condensation by means of the steam pressure acting on one leg of a U-shaped piece of piping, so connected as to raise the water in the other leg high enough to enter a tank, from which it will flow to the boiler, the water level in the boiler being regulated by a float valve. Tredgold expressed an opinion very unfavorable regarding the use of heating with hot water circulation, and it is quite possible that he did not appreciate the force which caused such circulation.

Tredgold's book is ample evidence that the art of heating with fire places was rather more advanced in his day and time than at present, principally because they were more used. He gives detailed descriptions of fire-place constructions designed to utilize the heat to the best advantage and discusses the methods to be followed in securing perfect combustion and best results.

The treatise on warming buildings, by Charles Hood, written in 1844, is principally devoted to the method of heating with hot water. In general, the same observation regarding practice at his date could be made as in respect to the time of Tredgold. His work shows an excellent understanding of the principles of heating by hot water circulation, his methods being limited by the materials and workmanship available at his time.

Both Tredgold and Hood consider methods of ventilation as well as heating, and approximate rules are given for the motion of air in flues, which is caused by a difference in temperature.

In 1844, Dr. D. B. Reid wrote a work on the "Theory and Practice of Ventilation," which is a classic in its line, even to the present day. Dr. Reid's treatise shows that the science and art of moving air by difference in temperature was probably as well advanced as at the present time, and he gives detailed drawings of the construction of the ventilating system in the House of Commons and full description of the results of the various experiments in that building. His description of the ventilation in the House of Commons is well worthy a place in our proceedings.

Dr. Reid also describes a number of forms of fans or blowers which indicate that in many cases these were frequently used at that time for forcing in fresh air from the outside or exhausting it from the inside. The blowers, or, as Dr. Reid calls them, "fanners," while well known, were evidently not used to any great extent at his time, probably because of the difficulty of obtaining power to operate them.

The works of Peclet were printed in France about the same time as the books previously referred to, and these also illustrate the same propositions which I stated at the beginning of the article, and will not be further referred to in this particular time and place.

It will, I think, be generally admitted that if all our processes of heating were known in a general way, fifty or sixty years ago, our improvements have been principally in the line of details of manufacture, in adapting materials to a greater field of usefulness, and in working up standards for manufactured articles. The effect of the improvements has been, first a great reduction in the cost of the heating plant; second, greater economy in the use of fuel, and third, a greatly extended application of the improved systems and methods of heating.

The American excels practically every other nation, principally by his engineering ability, which is manifested by the production of simple and effective designs, by improved methods of manufacture by which the cost of construction is reduced and the quality improved. The ability of the American engineer along such lines is nowhere better illustrated than by the thousand and one, perhaps ten thousand and one, standard articles which have been constructed to meet every possible phase of demand for the heating and ventilating of buildings. As illustrations we have our standard pipes constructed of steel or wrought iron of any size desired; for these pipes we have an almost countless variety of standard valves and fittings. We have radiators in cast iron or steel of almost endless shape and variety and sufficient to meet almost any possible conception or demand of the user. We have standard heaters designed on scientific principles of so many varying proportions, sizes and shape that no demand can arise which cannot be **filled.** This list could be almost indefinitely extended; it serves to show that the art of heating and ventilation has greatly improved in the last half century. My previous remarks show that its improvement has been more greatly in engineering and manufacturing lines than in scientific or philosophical lines; still, I do not wish to convey the impression that we have made no progress in the use of new processes for heating or in the application of scientific principles to new processes, for I think as an illustration it will be found to be true that vacuum systems of heating which are now common with us were not described fifty years ago, and doubtless many of the gentlemen here present will call attention to other recent improvements not referred to in the early publications.

British Institution of Heating and Ventilating Engineers

This institution held its annual meeting January 17 at the usual place, the Holborn Restaurant, London.

The following officers were elected for the ensuing year:

President, George Crispin, Bristol.

Vice-Presidents: W. Nelson Haden, A. B. Simpson and W. Yates.

Secretary, A. Taylor.

Treasurer, Edward Taylor.

Council: C. Mason, E. W. Mayner, J. M. Greenall, J. L. Saunders, C. Barker, A. H. Barker, T. Potterton, Robert Crittall, W. W. Stroud and H. H. Grundy.

J. D. Sutcliffe read a paper on "The Practice of Ventilation."

Medals for papers previously presented were awarded by the president as follows: J. Nelson Russell, on "The Determination of Heating Surfaces," silver medal; A. J. Baker, "The Testing of Large Installations," bronze medal.

The subject for the next prize essay is "The Installation of Low Pressure Hot Water Heating Systems in Private Residences."

During the meeting the Secretary was authorized to send a cablegram, expressive of good wishes, to the American Society of Heating and Ventilating Engineers, assembled at that time at the Hotel Astor, New York. The message was followed up by a letter to Secretary Mackay, copy of which we give herewith:

I have great pleasure in confirming our cablegram sent to you on Tuesday, January 17.

It was proposed by Mr. J. Nelson Russell and Mr. W. Nelson Haden, both of whom are members of your Institution, that we should send a cablegram to you with greetings from this Institution, which was done, and we trust you received it in due course. These gentlemen appreciated very highly the kindness you showed them during their stay in America, and our members unanimously agreed to send you hearty greetings.

Yours faithfully,

(Signed) A. Taylor, Secretary.

London, January 19, 1905.

Superb Men, the "Average" Manufacturers

"National Association members believe," said a Boston manufacturer recently, "that the great saving grace of our industrial situation is that superb group of men, the 'average' manufacturers, who don't expect to go into big combinations, who are turning their capital over rapidly and profitably, who are getting along first rate, who are independent, and who intend to continue so to be.

"Moreover, they don't want to see our country go the way of England industrially, and hence the labor question interests them.

"Finally, they realize (for themselves as individuals, if they are doing exporting, and for the country, as a country, if it has broken its commercial bonds), the immense importance of our foreign trade."

For the Sake of the Incompetent or the Sluggard

This grading down of workmen to the standard of the poorest, says the *Brooklyn Eagle*, is utterly against the whole trend of American life. The glory of America is that we hold open the door for the man who is fit to rise. In every line of our development most of the bosses are men who have worked up from the bottom by superior force and industry. This system of fixing the wages by the production of the slowest men removes all incentive for extra effort and shuts off the chance of the ambitious and competent to show those qualities and thus put themselves in line for promotion. It sacrifices the good man for the sake of the incompetent or the sluggard, whose one claim to consideration is that he has joined the union, pays his dues and must be protected. The ultimate result must be that the bosses, superintendents, designers, and all the men whose work requires trained capacity will be taken from the trade schools. The mechanic in the ranks will always have to stay in the ranks because he has no chance to prove the capacity which he may have.

AMERICAN SOCIETY OF HEATING AND VENTILATING ENGINEERS

The newly-elected Board of Governors of the Society held a meeting in New York, January 21, presided over by Prof. Wm. Kent, the new president, who appointed the following committees:

Executive: C. B. J. Snyder, R. P. Bolton and B. F. Stangland.

Finance: R. P. Bolton, C. B. J. Snyder and B. F. Stangland.

Membership: B. H. Carpenter, J. C. F. Trachsel and James Mackay.

Publication: Wm. Kent, A. B. Franklin and W. M. Mackay.

It was decided to hold the **summer** meeting at some point in the West, July 7 and 8, the choice ranging between Chicago and Milwaukee.

Since the meeting Secretary Mackay has issued a postal ballot to the members, asking each to state whether he will be able to attend the summer meeting and also asking him to express his preference between Chicago and Milwaukee.

THE HEATING AND VENTILATING MAGAZINE

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WILTSIE F. WOLFE, Vice President.
WM. M. MACKAY, Treasurer.
HENRY L. HALL, Secretary,

BOARD OF DIRECTORS.

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The Board of Directors regrets to announce the resignation of Mr. H. A. Smith as Editor of THE HEATING AND VENTILATING MAGAZINE, taking effect January 31, 1905.

The management of the Magazine will be assumed by the Executive Committee.

All communications are to be addressed to

The Heating and Ventilating Magazine Co.,
WM. M. MACKAY, Treasurer,
235 Water Street,
New York City.

WHILE the proceedings of the recent meeting of the American Society of Heating and Ventilating Engineers marked a decided step in advance in the accumulation and discussion of scientific data, it brought out more clearly, perhaps, than any previous meeting has done, the lack of knowledge possessed on certain points that were on the program for discussion. Few, if any, for instance, who took up the topic, "Grate and Heating Surface and Their Relation to Space and Exposure in Furnace Heating," expected that the discussion would take the turn that it did. We commend to our readers' attention the comments upon this topic. The fact that a committee was appointed for the purpose of collecting furnace data proved a frank acknowledgment and a promise, the results of which will undoubtedly add valuable information to the store already obtained by the Society.

WE regret to note that the paper on "Circulation of Hot Water," read by Mr. John S. Brennan, was published in many quarters without the discussion which followed it. This was unfortunate, both for the Society and for Mr. Brennan. Concerning more than one feature of the paper, the results achieved, as Secretary Mackay said, "are exactly opposite to those obtained in the average hot water plant." Similar comments were heard from Prof. Kent and others, which brought forth the explanation from Mr. Brennan that the article in question was the result of certain experiments, which might or might not hold true as a general rule. Meanwhile the paper, without comment, has found its way into many of the trade papers, carrying with it the stamp of approval of the Society.

IF this incident, however, serves to increase the vigilance of the Board of Governors in accepting papers to be read at the Society's meetings, it will have accomplished a useful purpose. The importance of this matter cannot be too strongly emphasized. The present custom of circulating the papers prepared,

both among the Society's members and for the convenience of the trade press, results in their publication at, if not before, the time of the meeting where they are to be read. Any errors, therefore, either typographical or as regards the articles themselves, are given a circulation as wide as the limits reached by the papers that print them, and their publication in the name of the Society might easily hold up the organization to the derision of all who notice the faults referred to.

THERE are indications of some tendency on the part of heat-contractors to defer the placing of orders, apparently having in mind a possible reduction of price. We have investigated this question and fail to discover any good ground for such expectation.

A year ago radiators were selling at about 15½ cents per foot. At that time the price of iron was about $12 or $13 per ton. To-day the ordinary price of radiation is perhaps 18½ cents and iron is selling at about $18 per ton. It will thus be seen that the advance in the finished product has not kept pace with the increased price of the raw material.

Other elements entering into the cost of radiators have increased in a greater or lesser ratio, and all that has been said about radiation applies to house heating boilers.

It will thus be seen that instead of any good reason existing for manufacturers to contemplate a reduction in price, it is presumable that they are earnestly wishing for some development that would make it possible for them to advance and thus bring their margin of profit back to its old basis.

While there is nothing to indicate any such development in the near future, it is pretty certain that heating contractors have nothing to gain by holding off their orders in the possibility of their losing something.

A PROMINENT New York daily paper has a little quiet fun at the expense of an electrical periodical, which in extolling the merits of electrical fans has said that they keep you warm in winter as well as cool in summer.

The proposition of the electrical periodical seems to be that if the radiator is too small the efficiency of its scant surface can be increased by operating a little electric fan located at the base of the radiator.

Now we have not seen the article in question, but we think the daily paper man is wrong. He draws the inference that an electric fan so located is expected by the fan man to get more heat out of the radiator in cases where the boiler power is inadequate, and therefore the steam pressure is low. Of course it does not require much technical or practical knowledge to enable one to reason out that if a radiator is transmitting to the surrounding atmosphere all of the heat units that come to it from the boiler, no very obvious advantage can be gained by increasing the efficiency of its conducting properties. It is not likely that any well informed fan man ever advanced the proposition that even the most cunningly devised fan can make two heat units grow where only one grew before.

The other half of the *Times* editorial writer's proposition is equally incorrect, but incorrect in another way. He finds fault with the proposition that a fan located near the base of a radiator of insufficient surface

will increase the efficiency of that surface. His opinion is contrary to general knowledge. What a steam or a hot water radiator does is to transmit heat from the contained water or steam to the surrounding atmosphere. The faster the steam or water passes over the inner surface of the radiator the more heat it will give off, and the faster the air moves over the outside surface of the radiator the more heat units it absorbs. That is so easy to see that we wonder the *Times* man did not think it out for himself.

Many engineers have had experience with indirect heating jobs where the boiler had ample capacity to properly heat the building, but the radiators were too small to give off the required amount of heat; when, for ventilating purposes, a fan system was installed, those same indirect radiators would prove entirely adequate.

The electric fan people are not likely to create a very big market for little disk fans to be used for increasing the capacity of radiators with insufficient surface because, in the first place, where a heating job fails to heat, it is as likely to be the fault of the piping or the boiler or the firing, as of the basis on which the radiating surface has been figured and installed, and if it is really due to the insufficiency of radiating surface, it is probably up to the heating contractor to make his contract good by putting in sufficient surface. Even if he cannot be compelled and does not feel disposed to do this, it is probable that the owner will have it done at his own expense rather than to install and operate a fan at the base of each inadequate radiator.

The suggestion is a good one, however, and of value in those cases where the combination occurs of scant radiation and an electric fan already conveniently at hand.

WITH the general contractor left out, there are always possibilities of explaining to the architect or the house owner why he should have a little higher grade of heating and ventilating work.

A man who is putting up a fine house or a high-grade office building wants it good. He wants to put in about the best thing he can learn about in the line of heating and sanitary equipment, but with the owner and the architect eliminated from the field of discussion and everything left to the general contractor, there is no earthly reason why the general contractor should not do what he has been doing all these years, put in the cheapest job that he can buy at the cheapest bargain counter in the country. That is entirely proper from his point of view and there is no good ground for any objection on the part of the house owner who has put his interest entirely in the hands of a man whos only purpose can be to squeeze out of the deal the last dollar of profit.

The general contractor is therefore, a general nuisance so far as he affects the relations between the owner of a building and the heating engineer who wishes to install a good piece of work.

When a comparison is made of the number of trade and technical publications as compared to the total issue of the metropolitan press, and their relative value to the trade and commerce of our country, it will be found that the public value of the trade and technical press through their columns of information and advertisements is so far in advance of the metropolitan press as to astonish the world.—*Trade Press List.*

SMOKING COMPARTMENT REFLECTIONS

W. Nelson Haden, who is elected first vice-president, made many friends for himself on the occasion of his protracted visit to this country a year or two ago.

J. Lambert Saunders, who is elected a membor of the council, learned the heating business in Detroit, starting about seventeen years ago, and was engineer and draftsman for the Detroit Heating and Lighting Co., and afterward salesman, New York manager and Chicago manager for the U. S. Heater Co.

When Saunders decided to get into the boiler business, a salesman pretty nearly had to learn the trade, so he started out as a fitter's helper and afterward as a fitter having charge of jobs, then he took the drafting board and, as he was previously an architectural draftsman, he got on very nicely with that.

All this preparation made him look to the management like a man who could go out on the road and sell goods, which he accordingly proceeded to do, and stayed at it until he got a tempting offer to go back to his native island where he seems to have made a pronounced success.

I remember one funny thing about him. He had a distinctly English accent and manner which did not always commend him to the trade on this side, and most of us thought his pronounced "Englishism" was a drawback.

He went over to England one time for a little visit, and when he came back he reported that his family and friends immediately commented upon his very pronounced American accent and wondered if he "always talked that way," or if he was simply trying to impress upon them that he had spent some time on the other side of the globe. So for a few minutes he was between the devil and the deep sea. On this side we thought he was too English and in England they thought he was entirely too Yankee.

He achieved his final distinction when, as guest of honor at a banquet of the Carbon Club, he was called upon for a speech which elicited enthusiastic applause.

Rochester is a nice sort of town, but they sometimes furnish the wrong kind of smoke. No well regulated smoker likes to be smoked out of bed during the small hours of the morning with the smoke from oily waste burning in the cellar.

That happened the other night in a leading hotel of Rochester, and not only were the guests thrown into a panic, but the fire department came out and turned streams on everything they could see that was damageable by water.

On one of the upper floors the president of a large company, manufacturing heating apparatus, had a front room, while the room directly across the hall was occupied by one of his salesmen. Hearing the alarm, the president rushed to the window, thrust out his head, saw what was the matter, and promptly withdrew it just in time to dodge a stream from an enthusiastic pipe-man. At that

moment in rushed the salesman with his clothes on one arm. Seizing Mr. President's clothes he shouted, "Hurry up! there is no time to lose," and disappeared into the crowd. The president found some shoes and was last seen wandering around the streets of Rochester in his pajamas in blizzard weather, looking for the panic stricken salesman and his kidnapped garments.

I am glad to notice that two of the British heating and ventilating engineers known to many of us on this side have been elected to prominent offices for this year by the British Institution.

The top of the chimney should be higher than the house and everything that surrounds the house. See that it is. A boiler has no draft in itself—you've got to create it—can't do it if the height of the flue won't permit. But don't go to extremes—too "strong" a draft is as bad as one too "weak." See that the flue is perfectly clear, don't guess—look and see.

Close up all openings, except the one to which the boiler is connected. Look below the chimney connection—perhaps there's an "air-pocket"—such would cause down-currents in the flue. When flue runs lower than necessary, run a sheet-iron plate across it six inches below smoke-pipe connection—cement it over to make it air-tight. In case of fire-place or closet built in front of chimney, see that flue has not been reduced in size at that point, even though it shows full size at top and bottom, it may be narrowed in the middle. Always have the flue open up to full size all way. Inspect the chimney, and, if it's an old one, see that no mortar has fallen out between bricks—this allows air to leak through and spoil the draft. Fill up all holes in flue and plaster them over. If chimney is new, it will take a week or two to dry it out—don't hurry the drying.

Sometimes smoke pipes are run too far into the flue and the draft cut partially or entirely off—a little care and a tight-fitting collar will avoid all this.

It's a good plan to place an upturned elbow (mouth upwards) at the flue-end of the pipe just inside the flue when other simple remedies don't improve a stubborn draft. This can be done by cutting a tooth-pick joint in a pipe length.

Get it out of your customer's head that he must make a boiler fairly "eat coal" to give heat—a fire can be kept from 8 to 12 hours economically and efficiently by a little practice and common sense. Stir a fire up thoroughly twice a day—night and morning—and remove the ashes. Keep the ash-pit closed—it rushes the fire and wastes the heat. If clinkers give trouble, the draft is probably too strong—or the coal poor—turn the grate over and break them up; rake if necessary to break up the mess—then shake grate enough to loosen the fine ashes which stick to the sides of partly-burned fuel.

Fill the coal chamber full to the top of the fire-pot—good "stove" coal gives best results for ordinary use. Open up draft long enough for the whole body of coal to ignite. Turn off draft after body of coal has started to burn—if necessary, open smoke-pipe check—this will permit the natural draft of burning fuel to continue to furnish the oxygen necessary for perfect combustion.

If, through defects in the chimney, draft is poor, close the smoke-pipe check and leave the draft-inlet door partly open, especially if cold weather. Opening the feed-door will check and cool the fire rapidly—keep it closed if you want to keep the fire.

I heard rather a good story the other day, which seems to constitute a horse or four-in-hand team on some pretty prominent men.

A large institution in New York was equipped with heating and sanitary devices, with less regard to expense than to results; in fact the appropriation was exhausted and the board of directors went into their individual pockets to make up the deficit.

One of them was talking about it and said it was a funny thing. Mentioning the names of perhaps the most prominent men in their respective branches, he said we had ———, for our architect; ———, for our heating engineer; ———, for our heating contractor; ———, for our sanitary engineer, and ———, for our plumbing contractor. We bought all of our goods from the best people in their line, *and yet we get no hot water.*

On the face of it, this seems to be a large-sized joke on a bunch of estimable gentlemen, but it happened that one little appliance was the root of all evil, and that seemed to have been corrected, but I can fancy the feelings of the chairman of the building board after a few months, when it had dawned upon them all that after exceeding their appropriation and putting up extra money, they had failed to get results in an important respect.

On the subject of memory and measurements, I recall a little incident of some years gone by. I was in the office of a medical man, upon whom it devolved to fix up some part of my anatomy that had become deranged, and a gas fitter's man came in to get the measure for a little piece of half-inch gas-pipe to go in his wash-room. The doctor let the man in and let him measure, and when he started out he said, "What measure did you get?" The man said, "36½ inches." The doctor said, "That is not right," and, excusing himself, went and took a two-foot rule and measured it up, showing ¾ of an inch discrepancy.

After the man had gone the doctor came back and I said, "How in the world did you know that that was not right?" He said, "I did not know anything about it, excepting that none of those fellows ever get anything right; I knew he was going to be wrong. I did not know whether he was going to be an inch or half inch too long, or an inch or half inch too short, but I would have gambled all my earthly possessions that he would be wrong."

I am glad to say that this is not in accordance with my experience. I presume this is because the cases that have been called to my attention have been the cases where men have made a marvelous guess, or estimate, or measurement, and that the cases where they guess or estimate, or measure wrong, are not presented for exploitation in the columns of a trade paper.

We notice the same thing about predictions. When a man guesses that he, or his wife, or his son is going to die at a certain hour of a certain day, if it comes to pass we all hear about it, but nobody ever hears about the 999 cases where similar guesses and predictions are not verified.

Scale can be removed from a boiler by adding to the feed-water one-quarter of a pound of soda per horse power—then steam for several hours, using powder during the cleaning—then blow off rapidly.

Clean the boiler mechanically afterwards if possible—if not, repeat the soda treatment.

Scale can be kept out of a boiler by adding an eighth of a pound of soda per horse power to the feed-water once a week.

When you are called on to put a heating-plant into good condition, or do any repairing for the winter-run, it's a good idea to give it the soda treatment if you think there is any reason for suspecting "scale"—you'll make so much improvement in the heating power of the plant that you are likely to get their next job.

If the fire is slow to warm up, don't blame the boiler the first thing—examine the chimney—defective drafts are invariably responsible for poor fires.

CORRESPONDENCE

"Computation of Radiating Surface."

Editor HEATING AND VENTILATING MAGAZINE:

The article on "Computation of Radiating Surface" in your November number has come to my attention. That I have been much interested is evidenced by the fact that I have spent considerable time in verifying the calculations. On page 179, Carpenter's rule is given as

$R=\frac{1}{4}\left(G+\frac{W}{4}+\frac{NV}{55}\right)$ and then substituting n for unity the formula is made to read R=.324G + 08W+ 006V.

Now this is manifestly incorrect, since the formula first given, reduced to decimal form, must read R=.25G+.0625W+ .004545V.

And this formula substituting the numerical quantities given on page 181, would give the result 94¼ square feet of radiation instead of 122.42 square feet.

This leads me to make a comparison of the article in question with Professor Carpenter's own work on heating and ventilating, and here it seems to me the discrepancies are explained. By reference to page 206, *Heating and Ventilating Buildings*, it is evident that Mr. Holbrook in his own practice follows exactly Professor Carpenter's data for steam at two pounds pressure, and in (11) on page 179 of the MAGAZINE he makes use of Professor Carpenter's formula at 10 pounds pressure while he reduces the formula to decimal form at atmospheric pressure.

Now it seems fair in making a series of comparisons to start with the same premise, for, in this instance at least, practically the same conclusions would be reached. It also seems a fair deduction to assume, as Professor Carpenter does, that "as extreme weather is usually of short duration, steam radiation can be proportioned safely for higher pressure than ordinarily maintained, say 10 pounds gauge." The writer uses a formula which is precisely that of Professor Carpenter, except that for convenience 50 is substituted for 55 in the last term of the equation, which gives a decimal value of .02V, is a much easier decimal to manipulate than .0182V as given in (5) page 179 of the MAGAZINE, and the error (?) is on the safe side. But after making all calculations most carefully the heating engineer must exercise a large amount of "judgment" in making adjustments if he is to always succeed with his installations.

"C. W. L."

Answer by J. Byers Holbrook

Editor HEATING AND VENTILATING MAGAZINE:

Concerning the various letters received by you in regard to my article on "Computation of Radiating Surface," published in the November issue of your paper, I beg to reply as follows:

First: Additional radiating surface required. It is my practice to figure ten per cent. radiation for west exposure, ten per cent. for north exposure and fifteen per cent. for northwest exposure. In computing the amount of radiation required for country residences, and generally, all buildings that are more or less exposed, I would add in the neighborhood of ten per cent. The additional amount required is extremely flexible, and no set rule can be given.

Second: For hot water heating. The difference of temperature between the flow and return water of 35 degrees is based on conservative practice. If the temperature of the return is figured greater than 145 degrees, the constant .52 (twelfth line from top of first column, page 181) is proportionally reduced, thereby reducing the amount of radiation to be installed. This latter practice is prevalent among heating contractors in their design of hot water systems, as is shown by a large number of residences improperly heated.

Third: Carpenter's Rule. The formula "E," page 179, R=0.324 G+0.08 W+0.006V is taken direct from Munroe's publication entitled "Steam Heating and Ventilation," page 68.

Fills a Good Sized Niche

Editor HEATING AND VENTILATING MAGAZINE:

Gentlemen:—We enclose copy of advertisement for your February number.

The writer wishes to take occasion to say that he has been an admirer of your magazine from the start, and believes that it fills a good-sized niche in the matter of trade publication, and is deserving of pronounced success.

NORWALL MANUFACTURING CO.,
Geo. D. Hoffman,
Sec'y & Mgr.

Chicago, February 7, 1905.

Editor HEATING AND VENTILATING MAGAZINE:

We shall be pleased to have your advertising rates for ads in your valuable little magazine. We are of the opinion that the MAGAZINE fills a long-felt want in the business.

Yours very truly,
NATIONAL STEAM SPECIALTY CO.
Per E. Edelmann.

Ventilation of Office Buildings

The heating of offices is well enough, but the ventilation is very largely neglected. These two are so closely related that they should be considered together. Present practice is to provide a radiator for heating controlled either by hand or a thermostat for each office unit, and to provide ventilation by opening the window, the foul air passing into the hall. The ideal arrangement would be to introduce a fixed amount of warmed, fresh, clean air to each office unit at any determined temperature automatically. In fact, there may be said to be no existing way of properly warming the bulk of the offices of an office building without the constant use of a little knowledge, intelligence and trouble. The foul air can be drawn off into a vent shaft placed at any convenient place. For banking and similar large rooms on lower stories the standard hot air heating system, with either exhaust of blast fans, works with entire satisfaction and but little loss of valuable room, but the air inlets should always be 8 feet above the floor and at least 5 feet from the ceiling, and the outlets for foul air should be near the floor and large enough to have a very low velocity (less than 10 feet per second). Then the occupants will not feel a draft. The inlet radiators must not be high up, because it is at times necessary to introduce the fresh air at a temperature lower than 100 degrees F. when it feels cold and produces the effect of a draft. If the fresh air forms a current flowing always in one direction, surfaces near it will get very dirty, and we are, therefore, compelled to keep away from the ceiling.—*Geo. E. Hill, in Architectural Record.*

Condition of the Working Classes in the United States

WAGES AND COST OF LIVING.

Mr. Seymour Bell, British Commercial Agent in the United States, gives in his report for 1903-4 some interesting figures taken from a bulletin issued by the Department of Commerce and Labor relative to wages and the cost of living there. He says that since 1894 wages have increased 18.8 per cent. in the United States, while the cost of living, as indicated by the selling price of various necessary commodities, has increased 10.6 per cent. Since 1896 wages have increased 16.6 per cent., and the cost of living has increased 15.5 per cent. This clearly indicates that the condition of the working classes generally has decidedly improved during the last twenty years.

The investigation of the department covered 519 occupations, representing 67 industries in 3,429 establishments, and included every important manufacturing center in the United States. The statistics are based on the retail price of food.

The increase in weekly wages in 1903 was 12.9 per cent. greater than in 1896, and 14.9 per cent. greater than in 1894. In 1903 the hours of labor per week were 4.1 per cent. less than in 1890, 3.5 per cent. less than in 1895, 2.1 per cent. less than in 1900, and 0.7 per cent. less than in 1902.

The aggregate of wages paid in 1903 was 45.1 per cent. greater than in 1896, and 54.4 per cent. greater than in 1894.—*Engineering Times.*

NEW DEVICES

Heating by Friction

A St. Joseph negro has made an invention which has been put in use, and it has been demonstrated that it will produce enough heat to warm the largest building in the city in the coldest weather without the use of coal or wood. The heat is produced by friction. The invention consists of a steel tube surrounded by a jacket, and inside of the tube a wooden roller cut into four triangular sections and arranged about a steel shaft. A water chamber outside of the tube is ten inches in diameter.

A two horse power motor is used to operate the machine, and tests have shown that at a speed of 700 revolutions it will heat 990 gallons of water to a temperature of 160 degrees in fifty-four minutes. At 700 revolutions steam is produced in five minutes from the time the machine is started. From that time on there is a gain of ten pounds of steam every three minutes. It has been shown that the machine will produce the wonderful gain of 200 pounds of steam an hour. The apparatus is being used to heat the First National Bank building.

We believe the cost has not yet been estimated.

A New Fuel

"Radiant" is the name given to a new fuel, invented by two young English engineers, which is expected to accomplish in heating about the same thing that the Welsbach mantle did in gas lighting. It is to be used in connection with a gas fire, and the inventors claim for it that it gives treble the heat with the same gas consumption as an ordinary gas fire; that it takes up the carbonic oxide from the air and purifies the atmosphere; that it does away with the unpleasant smell given off by gas fires; that it burns brightly like a coal fire; that it is as cheap as fire clay and inexhaustible.

It will be interesting to note the development of this new device.

TRADE AND MISCELLANEOUS NOTES

SAMUEL JACKSON, Pawtucket, R. I., died January 22 at the age of 58. Mr. Jackson was president and treasurer of the Samuel Jackson Heating Co.

B. F. ROBERTS, Philadelphia, Pa., died January 27. Mr. Roberts was a well-known heating engineer and was connected with Francis Bros. & Jellett.

Trade Literature

THE SHIRLEY RADIATOR calendar for 1905 is a most useful weekly calendar. White figures stand out boldly from the black background with red margins.

The ornamentation of the main card is in gold and pale blue, and a conspicuous feature is an engraving of the various heights of Shirley steam and hot water radiators. These calendars are issued by the Shirley Radiator and Foundry Co., Indianapolis, Ind.

SMITH & THAYER CO., Boston, are fertile in the production of new dodges to interest the trade in their goods. They had all of their customers guessing last fall.

Their latest scheme is quite as interesting and has the merit of possessing first-class practical value as an instructive proposition.

A circular lately mailed has catchy headlines in red ink, reading as follows:

Ever in hot water?

Are you good at estimating?

Want to learn how to keep out of hot water, yet supply hot water the cheapest and quickest way? Our award in December, 1905, will show you how.

This is sufficient to make the recipient of the circular sit up and read the following:

NOTICE

An estimating contest will be held by this firm, running from Feb. 1, 1905, to Dec. 15, 1905, inclusive, governed by the following conditions:

There is a residence in Brookline, Mass., in which a hot-water heating apparatus is installed (open tank system) comprising two "Winchester" boilers twinned together and covered with asbestos, one a 22-inch fire-pot, the other a 19-inch fire-pot, with 875 feet of Rococo radiation in fourteen radiators, and 312 feet in uncovered pipe and fittings.

On Dec. 18, 1905, under the supervision of two Boston heating engineers, this apparatus will be run as follows:

The temperature of the water in this apparatus will be allowed to cool to 80 degrees, at which time the fires will be shaken down, and one hundred pounds of fuel will be added to each heater. The dampers will then be adjusted and the fires allowed to burn themselves out.

You are desired to estimate the elapsed time in hours, minutes, seconds, and fractions that the temperature of the water in the apparatus will keep above 80 degrees. In other words, how much time must elapse before the water, starting at 80 degrees with 100 pounds of new fuel, will return to the same temperature, with no adjustment of the dampers.

CONDITIONS OF CONTEST

A "Winchester" boiler, either steam or hot water, that will heat his residence, providing same consists of a house of not more than fifteen rooms, will be given to that customer who estimates nearest the correct elapsed time.

Contest begins Feb. 1, 1905.

Contest closes Dec. 15, 1905.

In case there are two or more correct estimates, the estimate received in this office first will receive the award.

The award will be made by a congress of representatives of the Trade Papers.

One of the high-grade hot-water thermometers from Fritch Mfg. Co., of New York, will be used to make the test.

No person or relative of a person connected in any way with the Smith & Thayer Company will be allowed to compete.

Every estimate must come from a customer of the Smith & Thayer Company.

A chance to enter the contest will be given to every customer for every $25.00 worth of stock ordered and shipped from Feb. 1, 1905, to Dec. 15, 1905.

Blanks for estimates will be sent to customers with our monthly statements of goods shipped the previous month.

All estimates must be in the office of the Smith & Thayer Company at the close of the business day, Dec. 15, 1905.

All estimates must be written on blanks furnished by the Smith and Thayer Company.

All persons may become customers of the Smith & Thayer Company.

POWERS REGULATOR COMPANY, Chicago, have installed a very complete system of automatic temperature regulation in the new Minnesota State Capitol Building, just completed, at Saint Paul.

This building is heated almost entirely by the indirect system of fans and coils, and the Powers Company have installed nearly two hundred of their pneumatic thermostats to accomplish the automatic control of temperature in all the rooms of this building.

KINNEAR-HOOD STEEL CO., New York, have removed from 141 Broadway to 41 East 21st street, where they have adequate office space and handsome show rooms.

POWERS REGULATOR CO., New York, are completing an interesting piece of work in the atmospheric regulation of the new laboratory building of the U. S. Bureau of Standards at Washington. This building is warmed during the winter by a fan system and cooled during the summer by brine coils. The building is in an exposed location situated on a hill far from everything. It has been found necessary to keep at least 300 feet away from any roadway, as within that distance the horse-hoof beats would derange the delicate instruments. The Powers contract calls for regulation of the atmosphere within half of one degree.

It will be recalled that the Powers Company supplied the temperature control for the Government Standard Laboratories at the St. Louis Exposition.

PITTSBURG VALVE & FITTING CO., Pittsburg, Pa., have secured the services of L. B. Jenks, a prominent supply salesman long connected with the Western Tube Co., Kewanee, Ill.

ERNEST T. CHILD, who has long been connected with the B. F. Sturtevant Co., Boston, is now heating and ventilating engineer with the G. A. Suter Co., 112 Wooster street, New York.

BOYNTON FURNACE CO., 109 Water street, New York, have engaged F. W. Waggoner to represent them in Central and Eastern New York and in Vermont. Mr. Waggoner is an old-time plumber and for years a well-known traveling man.

WARREN WEBSTER & CO., Camden, N. J., are sending out as a piece of trade literature, a reprint of the paper read by request of the American Society of Heating and Ventilating Engineers at the Society's meeting in 1897 by Reginald Pelham Bolton. It is entitled, "Circulation of Steam for Heating Purposes at or Below the Pressure of the Atmosphere." The original paper has been rewritten by the author in order to bring the subject up to the present state of the art.

It makes a twenty-page pamphlet illustrated by a double-page diagram and several other cuts. Anyone interested in the subject can procure copies by addressing Messrs. Warren Webster & Co. at the above address.

THOMAS E. CRONE, whom we referred to in our January number as having connected himself with the International Heater Co., Utica, N. Y., has been appointed eastern sales manager of that company and will have jurisdiction over all territory not covered by the Chicago office.

J. L. MOTT IRON WORKS, New York, have engaged Thomas H. Guion to manage their boiler and radiator department in New England, with headquarters at 378 Boylston street. Mr. Guion is well known to the trade, having been connected first with the Pierce Steam Heating Co., afterward with the American Radiator Co., and lately with the Niagara Radiator Co.

MAGEE FURNACE CO., Boston, have withdrawn from the contracting business, having sold their tools, stock and furnace and range installation business to F. E. Woodward.

Mr. Woodward has been connected with the company for thirty-five years, and for the past twelve years has managed the heating and ventilating department, so that he is eminently qualified to carry on the business for himself. The name of the new firm will be F. E. Woodward & Co., and the location 19a Friend street.

J. L. MOTT IRON WORKS, New York, will soon abandon their present office quarters on Beekman street, having taken a long lease of a thirteen story building being erected at Seventeenth street and Fifth avenue.

GURNEY FOUNDRY CO., Toronto, Ont., started their new year with a dinner at the National Club. Heads of departments, office staff and salesmen, numbering about sixty, were the guests of the president, Mr. Edward Gurney.

A feature of the table arrangement was a miniature railway, traveling from Halifax at one end, to Vancouver at the other, the branch offices of the company being placed in front of their respective managers. President Gurney sat opposite the Toronto office, where there was a miniature cupola operated by electric lights and fans, and surrounded by boilers and radiators. The president acted as toast master and brought out a good many excellent speeches.

U. S. HEATER CO., Detroit, have secured the services of Thomas Farmer, as superintendent in their works. Mr. Farmer was formerly mechanical superintendent of the Detroit United Railway. Prior to that, general superintendent Russel Wheel & Foundry Co., and before that, superintendent of the Detroit plant of the American Radiator Co. Mr. Farmer has also been superintendent of a boiler plant and altogether his experience has been such as to eminently qualify him for his new position.

SMITH & THAYER CO., Boston, had all of their customers guessing last fall. The occasion was the offer of a prize of a Winchester boiler sufficient to heat the house of whichever one of Smith & Thayer's customers should guess the nearest to the popular vote cast for the Republican electoral ticket. Every customer had a guess for each $25 worth of goods purchased during the year, and there were several thousand guesses ranging from 1,000 to 15,000,000.

The successful guesser was J. H. Griffing, New Market, N. H., who guessed 7,627,227, which is close to the actual figure, 7,627,632.

PIERCE, BUTLER & PIERCE MFG. CO., Syracuse, have just added to their plant a new wood working building, 75 by 200 feet, two stories high. This makes the third large addition to their works within a year.

W. S. NEWKIRK, general representative of the Prizer-Painter Stove & Heater Co., with offices at 160 Fifth avenue, New York, sends us, with the compliments of himself and his company, a useful little vest pocket diary for 1905, on the front cover of which is the gold imprint of Henderson Water and Steam Heaters, manufactured by the Prizer-Painter S. & H. Co., Reading, Pa.

The Albany Return Steam Traps

have been the **STANDARD** for over **THIRTY-TWO YEARS.** For returning water under pressure to the boiler, they will perform this duty fully as well, and in many cases better than the so-called steam loop.

Send for circulars A, B, C and D.

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FREDERICK TOWNSEND, PRESIDENT — JAMES H. BLESSING, GEN. MGR.

TO THE TRADE

The New Directory for 1905 of Master Plumbers and Master Steam and Hot Water Fitters of United States and Canada, also list of Manufacturers and Jobbers, with classified list of goods manufactured in Plumbing, Lighting and Steam Heating, including the trade names of Closets, Bath Tubs, Hot Air, Steam and Hot Water Heaters and Boilers, is now being compiled. This Directory is the need of the day and a Buyers' Reference. Subscribers can have their name in display type without extra expense. Send in your order for a copy. Price $5.00 when published. Advertising rates given on application.

Plumbing and Heating Publishing Co.

Room 6074, Metropolitan Building — **NEW YORK CITY**

W. F. WOLFE, president of the Fowler & Wolfe Mfg. Co., Philadelphia, was called upon last month to deliver a lecture on The Heating and Ventilation of Public Buildings, under the auspices of the Northeast Association, No. 20, National Association of Stationery Engineers at Kearns Hotel, Philadelphia.

Mr. Wolfe is eminently qualified to speak on these subjects, having spent much of his life as a heating and ventilating engineer. He will be remembered by our readers as former president of the Heating and Ventilating Engineers' Society, and afterwards expert in charge of the United States Government's heating and ventilating exhibit at the Paris Exposition.

R. T. CRANE, Chicago, president of the Crane Co., has always been an enthusiast in regard to manual training. Now he proposes to establish scholarships for a number of the best students graduated from the Chicago Manual Training Schools to enable them to continue their studies at the Chicago Normal School to qualify them as teachers of manual training. Such work is better than founding libraries for the dissemination of light fiction.

Mr. Crane lately made his first appearance in New York after an absence of

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Engraver AND Electrotyper
ILLUSTRATIONS OF HEATING SYSTEMS A SPECIALTY.
NEW YORK · HARTFORD · BOSTON

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The only periodical in the world exclusively devoted to these subjects. Every heating and ventilating engineer and contractor should subscribe for it and read it.

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NEW YORK

"Dont Touch it,"

said a lady in a large institution to a perspiring visitor who had proposed to turn off the steam. "We don't dare touch it, no matter how hot the room is. It gets out of order so easily." With the

WEBSTER SYSTEM OF STEAM CIRCULATION

that is all changed. Each occupant keeps his room just as warm or as cool as he likes. There is no "getting out of order," no noise, no trouble of any sort. Its simplicity also reduces cost both of installation and operation.

Write for booklet 17-H.

WARREN WEBSTER & Co.
CAMDEN, N. J.

four or five years. He was able to find his way around very nicely and encountered a host of old-time friends.

"LOCALIZED EVERYWHERE" is said of the American Radiator Co. They have fourteen branch sales houses between Boston and Seattle and maintain thirty warehouses in order to help the trade to serve their customers better than could otherwise be done. In any section they are close at hand and "have the goods on them"—Ideal boilers and American radiators.

Business Changes

PETER TASTIAN has opened a shop at 1429 Fifth avenue, New York, to do steam fitting, etc.

HENRY DUNKER PLUMBING & HEATING CO., Davenport, Iowa, has been incorporated with a capital of $35,000.

AMERICAN HEATER CO., Worcester, Mass., has been incorporated with a capital of $140,000. The officers are: President, L. V. R. DeMark; Treasurer, E. E. Beach; Clerk, J. E. L. Todd.

CRYER RETURN LINE SYSTEM CO. has been incorporated by G. A. Morrison, Crawford, N. J.; A. A. Cryer, Newark, N. J., and L. A. McTigh, Brooklyn. The company's headquarters will be in the Park Row building, New York. Capital stock, $25,000.

GUY T. AHRENS, Davenport, Iowa, has purchased a large interest in the Iowa Plumbing & Heating Co., of which he will take the presidency. Mr. Ahrens is well known to the heating trade, having been for twenty years connected with the Davenport Plumbing & Heating Co.

JOHN ROBERTSON & CO., Chelsea, Mass., filed a petition in bankruptcy, with liabilities of $2,858; assets $425.

W. H. GRAY & CO., Houlton, Me., are a new heating and plumbing firm.

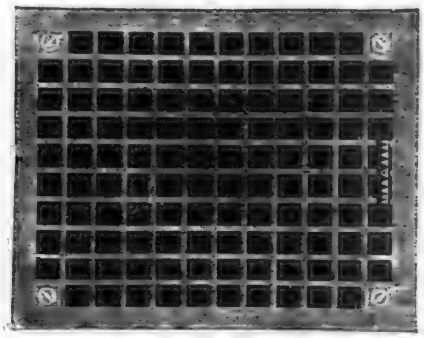
M. L. PARKER CO., Freeport, Ill., has been incorporated by M. L. Parker, J. F. Manion and L. L. Conter, to manufacture heating and plumbing supplies.

JOHN L. WALKER CO., Hamilton, Ohio, has been incorporated by John L. Walker, W. C. Schafer and James Ingram with a capital of $15,000, for the installation of heating and plumbing work.

THOMAS PLUMBING CO., Des Moines, Iowa, has been incorporated by J. A. Thomas, A. M. Fletcher and A. T. Johnson with a capital stock of $6,400, to do wholesale business in plumbers' and steam fitters' supplies.

McGOOKIN & FAY, 447 Plane street, Newark, N. J., is a new corporation in the plumbing, heating and sheet metal business.

KERNAN WELCOME REGISTERS



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Suitable for large work where architects wish a plain construction. We are prepared to make and furnish promptly any special sizes in this design and to electro-plate to match any finish of hardware or decoration.

Syracuse Stove Works, Syracuse, N. Y.

TELEPHONE NEW YORK OFFICE AND WAREHOUSE 231 WATER STREET 383 JOHN

FRANK T. YOUNG, Bar Harbor, Me., has opened a shop in the Porcupine building on Main street, where he is prepared to do all kinds of heating and plumbing work.

DANVILLE PLUMBING & HEATING CO., Danville, Va., is a new corporation with a capital stock of $10,000. The officers are: H. L. Boatwright, president; C. T. Fitzgerald, superintendent, and G. H. Greggs, secretary and treasurer.

L. E. POST HEATING & PLUMBING CO., Rice Lake, Wis., have opened a new shop at Chippewa Falls, Wis.

COLFAX HEATING & PLUMBING CO., Colfax, Wash., is a new concern, the members of which are J. E. Rentz, George Hillstrom and Jacob Forney.

W. E. MELLINGER, 142 Michigan street, Chicago, has filed a petition in voluntary bankruptcy.

Mr. Mellinger is one of the veterans of the business, having a wide acquaintance and excellent ability and experience. He will doubtless regain his business standing.

THE FORD CO., Reedsville, N. C., succeeds to the business of Ford Bros. It will be controlled by F. L. Ford.

HEALTH—COMFORT—ECONOMY

DEMAND AUTOMATIC CONTROL OF TEMPERATURE.

WE SUPPLY THE DEMAND

SEND FOR CATALOGUES

THE POWERS REGULATOR CO.

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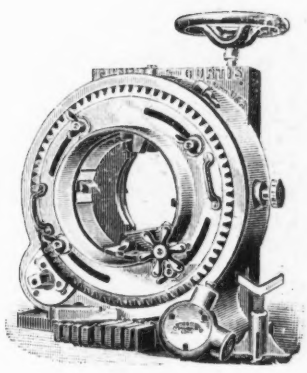
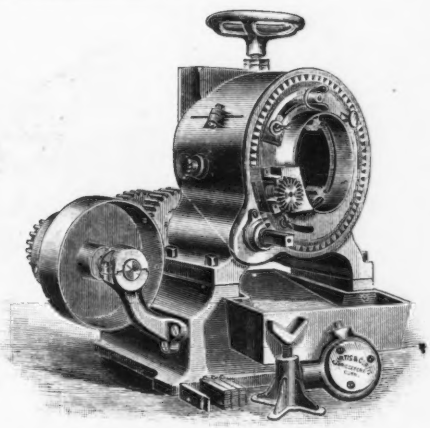
FORBES' PATENT DIE STOCKS

Pipe Cutting and Threading Machinery For Hand or Power



Pipe up to 15 inch cut off and threaded by one man with ease

PORTABLE and SIMPLE



SEND FOR ILLUSTRATED CATALOGUE

THE CURTIS & CURTIS CO.

48 Garden Street BRIDGEPORT, CONN.

THOMAS F. GAYNOR & CO., 550 Columbus avenue, New York, has been incorporated with a capital of $5,000, to conduct a plumbing and steam fitting business.

FRANK C. McLAIN CO., 264 Fourth avenue, New York, has been incorporated by Frank C. McLain, J. K. Peacock and C. E. Mead, with a capital of $300,000, to deal in gas, steam and hot water heaters, radiators and supplies.

RICHARDS & RHOADES, 207 North Sangamon street, Lincoln, Ill., have opened a heating and plumbing establishment.

STANDARD GAS & HEATING CO., Washington, D. C., has been incorporated by D. F. Pearce, Ralph Wormlee, E. L. Bradford, R. K. VanMater and P. H. Burch, with a capital of $475,000.

Contracts Awarded

ANDERSON-DARRAGH Co., Pittsburg, Pa., heating East End Charity Hospital.

McGINNIS, SMITH & CO., Pittsburg, Pa., heating Toxaway Inn., Toxaway, N. C.

SCHELL HARDWARE CO., Somerset, Pa., heating and plumbing Schaefer store and apartment building.

KORSEMEYER & CO., Lincoln, Neb., heating and plumbing new court house, at Dennison, Iowa.

J. B. DONNELLY, Fort Fairfield, Me., heating Journal Block, on Main street.

EATON HARDWARE CO., Brunswick, Me., heating and plumbing Cahill's Inn, at Lisbon, Me.

REZNOR PLUMBING & MFG. Co., Mercer, Pa., heating and plumbing residence of Mrs. Mary S. Gordon.

TRISLER BROS., 3315 Belmont street, Bellaire, Ohio, heating, plumbing and gas fitting Ohio Valley Telephone Co.'s building.

WILLIAM A. POPE, Chicago, heating new Graham School building, Forty-fifth street and Union avenue.

CAMPBELL - LAIRD HEATING CO., Minneapolis, Minn., heating new residence at 312 Malcolm avenue.

S. J. SMITH MACHINE Co., Ocean Park, Cal., heating and plumbing Ozone Avenue bath house.

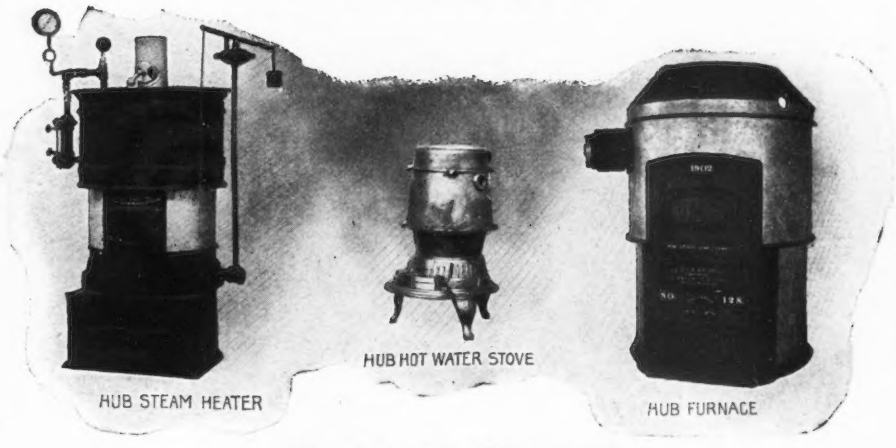
I. KRUEGER, Butte, Mont., heating new high school.

S. FAITH & CO., Philadelphia, Pa., heating building for Wm. F. Stief, 118 S. Seventeenth street.

C. W. SHARPE, Wheeling, W. Va., heating large residence for Mr. Steifel.

Hub Heating Apparatus

SUPERIOR IN DESIGN, CONSTRUCTION AND EFFICIENCY



Manufactured and Warranted by

SMITH & ANTHONY COMPANY, BOSTON

WORKMAN & CO., Grand Rapids, Mich., heating and plumbing the new building of the Wolverine Brass Works.

LYNCH & WOODWARD, 26 Beach street, Boston, heating Providence Telephone Co.'s building, Providence, R. I.

WILLIAMS HEATING CO., 81 Fulton street, New York, heating large apartment house, 600 Lexington avenue.

EMPIRE HEATING CO., 4177 Third avenue, New York, heating hotel at 161st street and Morris avenue.

L. R. WILLIAMS CO., 129 Beekman street, New York, heating nine flat houses, St. James Place, Brooklyn.

L. R. WILLIAMS CO., 129 Beekman street, New York, heating seven flat houses, Seventh street, Brooklyn.

WILLIAM OAKES, 1120 Pine street, Philadelphia, Pa., heating Somerset apartment house, Holly Beach, N. J.

MAKIN HEATING CO., 18 S. Seventh street, Philadelphia, Pa., heating residence of Mrs. Clarke Merchant, Devon.

JOHN J. DALY, 3061 Germantown avenue, Philadelphia, heating apartment house for W. H. Walker, Forty-eighth street and Warrington avenue.

DARK & CO., Buffalo, N. Y., heating large building at Blasdell, N. Y.

PIQUA HEATING CO., Piqua, O., heating and plumbing new Piqua hospital.

M. J. GIBBONS, 20 W. Third street, Dayton, O., heating and plumbing Fourth Presbyterian Church.

C. F. NEPPES, 2223 Berks street, Philadelphia, heating, plumbing and gas fitting bowling alley, Twenty-third street and Ridge avenue.

E. FRANK PAULLIN, 2014 Columbia street, Philadelphia, heating and plumbing new residence at Cynwyd.

GEO. W. HARTMAN CO., Twelfth and Oxford streets, Philadelphia, heating for Alcott Ross Co., 2917 N. Broad street.

C. T. INNESS & CO., 859 N. Franklin street, Philadelphia, heating Girard Avenue Theater.

VAN SICKLE & WARREN, 85 Water street, Cleveland, O., heating large residence of J. G. W. Cowles, Euclid Heights.

W. F. WILSON CO., heating Mack residence Scott and Pacific streets, San Francisco.

JOHN G. ILLS & CO., San Francisco, is installing steam cooking plant at the R. C. Orphan Asylum.

MANGRUM & OTTER, heating six-story building of D. L. Randolph, San Francisco.

FIFE BROS., Canton, O., heating new infirmary building.

JOHN O'DONNELL, Evansville, Ind., heating new opera house, Morganfield, Ky.

Thatcher Comfort Steam and Hot Water Heaters

Look at the interior construction of the Dome.

You can see at a glance how the products of combustion are retarded until all the heat units have been extracted.

This not only means fuel economy, but what is as important, the Dome makes a perfect super-heater, and nothing but absolutely dry steam is delivered to the radiation.

A Steam Heater, Range or Furnace that bears the "*Thatcher*" name-plate will bring sales and pleased customers to any fitter who handles them.

Thatcher Furnace Company

Works: Newark, N. J. **240 Water Street, New York**

"Novus" Wall Radiator

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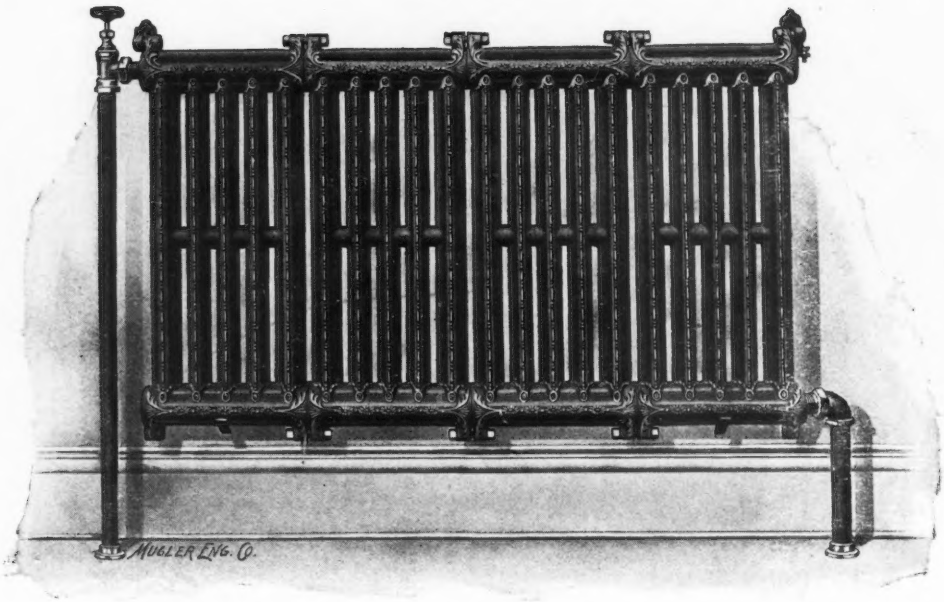

Slip Nipple Connections Consequent freedom from leaks when many sections are combined in one radiator. Easily assembled without special tools. **Artistic in Appearance**

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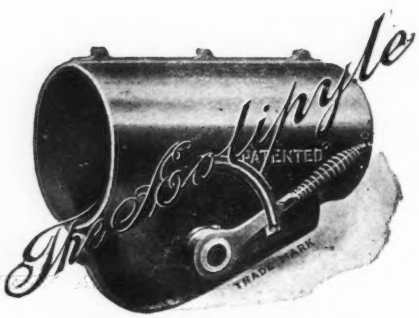
When applied to the Smoke Collar of a Furnace



SAVES Time, Labor, Coal.

PREVENTS Escape of Coal Gas.

GIVES Additional Heat and an even Temperature night and day.

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